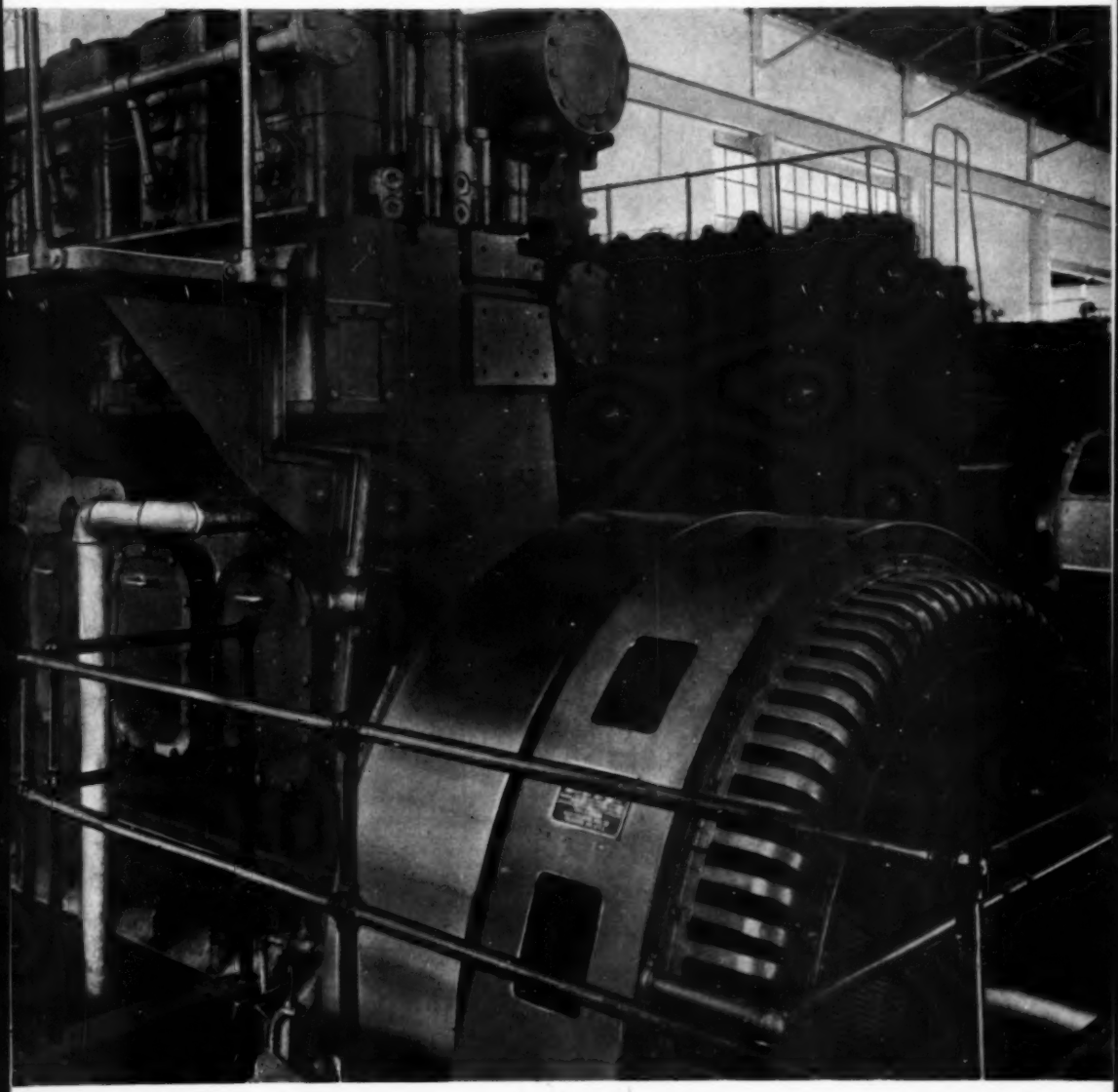
# INDUSTRY AND POWER

For Executives and Engineers Responsible For Engineered Plant Services



MARCH 1952

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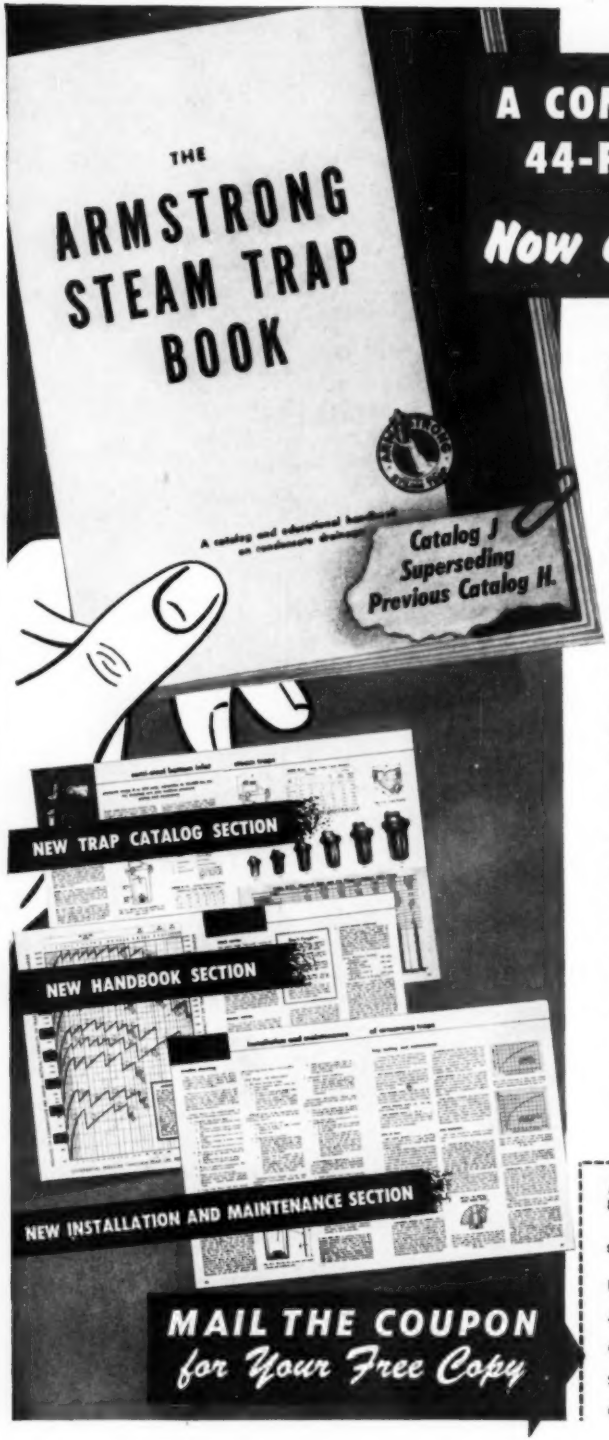


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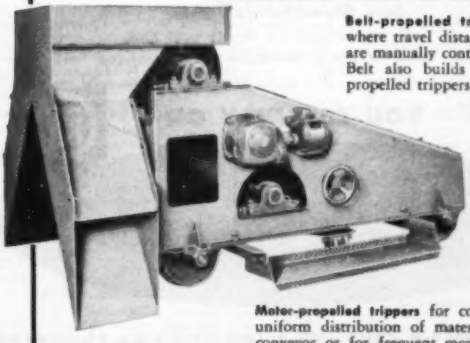

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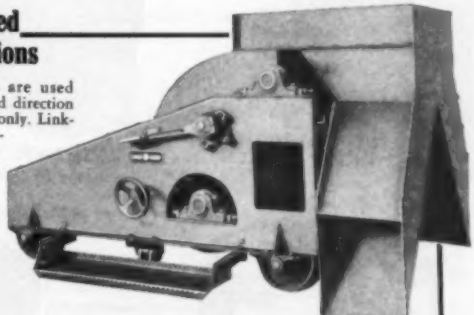

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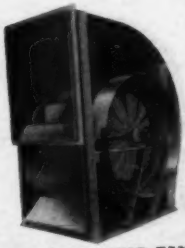

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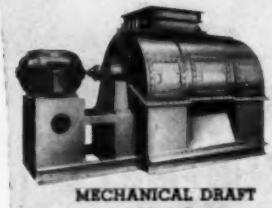

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# INDUSTRY AND POWER

*The Magazine for Engineered Plant Services*


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***Engineered Plant Services**

By ***Engineered Plant Services*** we mean the ***providing*** or ***generating, transmitting, controlling, applying,*** and ***maintaining*** of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial establishment as required for production and operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

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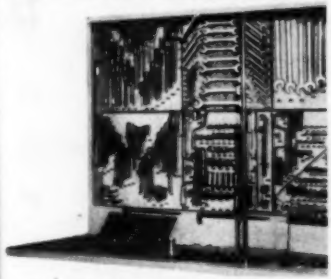

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# Acorns of science

***Developments not yet available, but of interest to those responsible for Engineered Plant Services***

### Measuring Rotational Strains

● Although developed for measuring stresses and strains on aircraft propellers in flight, the methods used at the Armour Research Foundation is applicable to other rotating equipment. Ordinary resistance type gages are used on the propeller blades, and connection is made through slip rings as in the past.

In the new technique, however, gages are connected in series, reducing the number 50 per cent. Increased sensitivity comes from the use of pulses of current, rather than the d-c ordinarily used. Frequency of pulses is thousands per second, but short duration allows much higher voltages.

### Computer Tricks

● General purpose master control panel, only 24 x 28 in., built at the Naval Ordnance Laboratory converts a regular IBM card-progammed calculator into the equivalent of a room sized electronic brain. It makes operations such as automatic generation of elementary trigonometric, hyperbolic and exponential functions and their inverses to seven decimal points possible in one second. It is also possible to print, store, punch or retain answers.

### Welding Copper

● Sigma welding, which uses the inert gas shielded arc process, with the exception that oxygen has been added to the gas to produce a controlled reaction, has been successfully used to produce welds on heavy thicknesses of pure copper by Linde Air Products Co. Test welds are reported to be sound with good contour, surface appearance and penetration, with credit apparently going to the ability of the oxygen to avoid water vapor bubbles and to reduce surface tension.

### New Lighting Equipment?

● Magnetic converters, which increase frequency of 60 c power to 360 c, may become familiar pieces of equipment in the future. The system, developed by General Electric Company for a testing laboratory, uses the converter to provide the higher frequency supply for fluorescent lamps. Small capacitors replace the heavier ballasts, and best of all, light output is up 40 per cent.

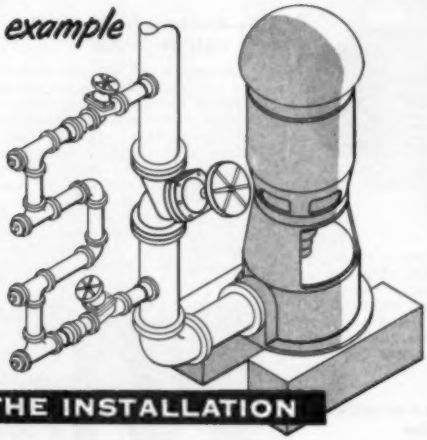
### Parallel Projects

● Generation of small amounts of electric power from heat energy of the experimental breeder reacto in Idaho was produced by steam vaporized by metal liquified by the heat of the reactor. Along with information obtained on handling liquid metal under radioactive conditions and on extraction of heat from the reactor, the major goal is the conversion of nonfissionable into fissionable material more rapidly than neuclear fuel is consumed. This suggests the power plant may also be a manufacturing plant.

### Deterioration Control

● With overall cost of deterioration in this country estimated at 12 billion dollars annually, work of the Prevention of Deterioration Center of the National Research Council is important. As reported by Arthur D. Little, Inc., the Center has indexed over 15,000 reports on research and development concerning deterioration of both assembled equipment and individual materials, such as wood, leather, metals and fabrics; and annually issues 2000 pages of abstracts of the reports to subscribers in government, industry and universities. The Center othewise coordinates the program by acting as a clearing house and consultative agency on technical problems.

# How's This For Solving a Valve Problem ...on Corrosive Well Water, for example



## THE INSTALLATION

On outlet of well water pump supplying plant of Barr Rubber Products Co., Sandusky, Ohio. Sulphur content of water extremely high.

## VALVE SERVICE RATINGS

**SUITABILITY:**
*Just what was needed*

**MAINTENANCE COST:**
*None to date*

**CORROSION-RESISTANCE:**
*No evidence of corrosion*

**SERVICE LIFE:**
*Outlasted any 2 other valves so far*

**OPERATING RESULTS:**
*Pump shutdowns for valve repairs stopped*

**PRICE:**
*Much less than alloy valves*

**AVAILABILITY:**
*Stock item in Crane line*

## THE HISTORY

Valves formerly used here lasted no more than 6 months. Under constant exposure to severe erosive and corrosive effects, they failed to provide the easy operation and positive seating needed in this service. They required excessively frequent re-packing and seating maintenance.

Problem solved by replacing with Crane Packless Iron Body Diaphragm valves in main line and by-pass. Installed more than a year, they show no corrosion, no effects of service. Operate smoothly, seat tightly, with no maintenance needed to date.

## THE VALVE

Crane No. 1611 Iron Body Packless Diaphragm Valves featuring separate disc and diaphragm. No packing to maintain; no stem leaks. Neoprene diaphragm used to seal bonnet only. Independent disc with neoprene insert insures positive seating even should diaphragm fail. Also fully neoprene lined valves. Many common and corrosive services. See your Crane Catalog or Crane Representative.

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# New equipment and developments

**Highlights of new products by leading manufacturers**

***Each new product item has a key number for your convenience in asking for additional, detailed information. Insert key number on return post card on page 131***

**Starting with this issue the "New Equipment and Developments" department will appear in its entirety in the front section of the magazine. The "New Bulletins and Catalogs" department will appear in its entirety in the back section. This change is being made to allow the reader to follow through each section without interruption, and is in keeping with our policy of making INDUSTRY AND POWER increasingly useful for our readers.**

### 1—Gear drive is for screw feed conveyers

Boston Gear Works announces a new Boston Reductor, Model C9-U52, for quick convenient application and efficient operation of the widely used 9 in. screw feed conveyers. It is equipped with a built-in adapter flange for ready installation by direct

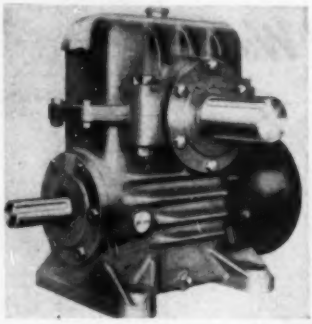
mounting with the conveyer trough. A separate sub-base assures precise alignment. These reductors are also furnished with special diameter output shafts at slightly higher cost, and will be available for other standard sizes of screw feed conveyers.

### 2—Insulating varnish withstands shocks

Insul-Film, an insulating varnish with advantages of the silicones, but less expensive, has been developed by the Electrofilm Corp. It has excellent solvent and abrasion resistance, possesses good adhesion, and withstands severe vibration or shock. The material has the advantages of a flexible baking cycle, 300 to 400 F for approximately one hour, and can be sprayed, brushed or dipped. Recommended temperatures are to 400 F.

### 3—Speed reducers have universal mountings

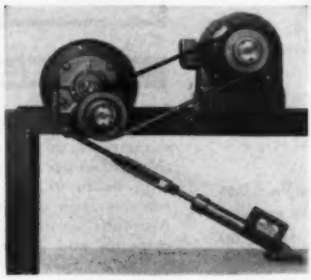
Crofts Radiation Speed Reducers, a line of worm reduction gears, is about to be introduced by National Transmission Distributors, Inc. A variety of ratios are offered, ranging from 5 to 1 through 100 to 1 and from fractional up to 400 hp. The smaller units (1⅜, 1¾ and 2¼ in. dia) feature



universal mounting for worm on bottom, top or vertical installation. Legs are removable and can be mated to other holes in housing to permit varied mounting. Ten sizes ranging from 3½ through 14 in. are all fan cooled and combine efficient operation, maximum power output and minimum case dimensions.

### 4—Overload release provides instant protection

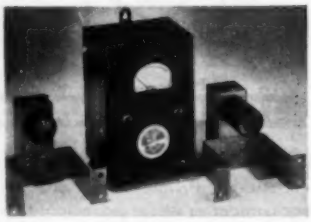
An overload release for the Dodge torque-arm speed reducer which provides instant and positive protection for driven machines, motors and the speed reducer itself, has been developed by the Dodge Manufacturing Corp. Designed to prevent breakdowns and



expensive repairs resulting from any excessive load on the equipment, it has been named Dodge Tri-Matic overload release because of the triple protection it affords. It operates mechanically and electrically to loosen the belts, cut off the current and activate a warning bell, siren or light. The release acts instantly and positively. Pressure exerted by an excessive load causes a piston to move lengthwise through the unit, loosening the belts and cutting off the current simultaneously. The warning system is actuated by a microswitch. The release can be set for any desired load up to the reducer's maximum capacity. To reset, the speed reducer is pulled manually back into position, which automatically cocks the release mechanism.

### 5—Smoke indicator unit easy to install

Excessive smoke not only involves violations of smoke ordinances but also indicates inefficient fuel consumption. Smoke indicators and controls manufactured by Cleveland Fuel Equipment Co. are photoelectric cell systems which provide a constant check on smoke density. The system consists of a light source, a photoelectric cell whose output is proportional to the density of the smoke, and a master control with amplifier, relay, smoke density meter calibrated in Ringelmann units and signal lights. Ease of installation is featured. Standard units



are available for either 110 or 220 v, 60 c current. The light source and photoelectric cell units are centered over 2 in. holes in opposite sides of the breeching. The master control, which may be located remotely, can be set for a predetermined smoke density and no further adjustment is required. To eliminate cycling, a time delaying circuit permits a small amount of smoke to pass before starting the control.

### 6—Aluminum tubing has many uses

Aluminum Co. of America has announced Alcoa Utilitube, a general purpose aluminum coiled tube made of Alcoa aluminum alloy B50S-O. It combines low cost per foot, easy workability and high fatigue strength among its advantages. It can be used in fuel oil, gasoline and lubricating oil lines for internal combustion engines; in fuel gas lines for stoves and heaters; in air, vacuum and hydraulic lines for brakes and instruments; for handling kerosene, fitting compounds, or refrigerants with the exception of methyl chloride. Flaring and forming characteristics are good, and it has excellent resistance to vibration and corrosion.

***( Continued on page 12 )***

# All these Valves . . from One!

**Valve combinations for 90% of industrial piping assembled with 4 bodies and a handful of parts.**

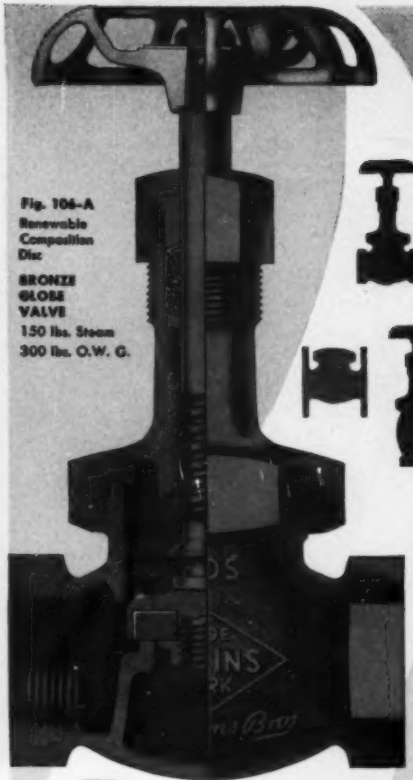
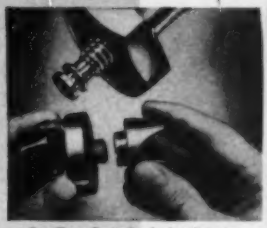


**Fig. 106-A**
Renewable Composition Disc

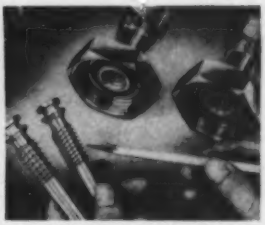
**BRONZE GLOBE VALVE**
150 lbs. Steam
300 lbs. O.W.G.

**JENKINS FIG. 106-A "FAMILY"**

Start with the standard Fig. 106-A. Trimming is interchangeable in Globe or Angle body, screwed or flanged.



**For Close Control** — In throttling service, the nut which holds the disc in the disc holder is removed and replaced with Throttling Nut, Fig. 344.



**For Quick Opening and Closing** — Merely substitute the bonnet and spindle from Fig. 941, in which threads are pitched more sharply.

**For Lift Check Service** — Globe or Angle Bodies can be fitted with interchangeable Cap, Disc Holder, and Guide Disc Nut from Fig. 117A. Addition of spring from Fig. 655A provides spring loaded service.

**For Stop & Check Service** — Use the 106A trim, but substitute this spindle from Fig. 630A and replace the regular disc nut with the check valve guide disc nut.

Look over these pictures and see how easy it is to make up just the valve type you need, simply by interchanging parts. Think of the saving this means in maintenance expense . . . in reduced inventory of spare valves in your stockroom.

That's a big reason why the Fig. 106-A series takes top honors in any poll for valve preference. And Jenkins time-proved design, makes them the longest-lasting, lowest-upkeep valves that money can buy.

For example, see the heavy construction of the one-piece, screw-over bonnet. You can remove and replace it over and over again without distortion. See the extra size packing box,—and the perfectly machined threads on the heavy manganese bronze spindle, with more threads in contact with the bonnet, open or closed.

Remember, Jenkins Bros. is the originator of the renewable composition disc valve,—the *only* manufacturer of both valves *and* discs. For drop-tight, trouble-free performance, get acquainted with the Fig. 106-A "family". Despite their extra value, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Ave., New York 17, N. Y. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

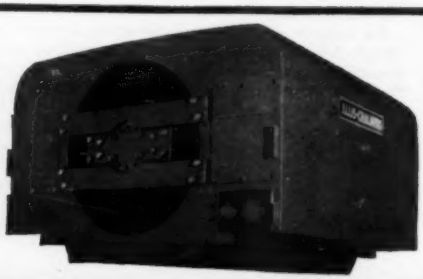
Jenkins Bros.

*WA-Series*

**STEAM TURBINE GENERATOR UNIT**

# Doing Double

## AT ONE OF WORLD'S LARGEST MALT



**SIMPLIFYING INSTALLATION,** both turbine and generator (shown at left) are shipped as complete assemblies with the rotors locked in place. The WA-Series generator is of the housing type with air-coolers mounted in the stator above the floor lines, eliminating special coolers and duct work.

## Ladish Malting Co. Uses Steam for both Processing and Power Generation

# Duty

## *HOUSES!*

GREAT QUANTITIES OF STEAM are required in the process of manufacturing 10 million bushels of malt annually at the Ladish Malting Co., Jefferson Junction, Wisconsin. And, as an economic by-product, the electric power needed for plant operation is generated by the same steam.

When this world's largest single unit malt house recently needed more generating capacity, Allis-Chalmers again was chosen. And with good reason, since two Allis-Chalmers units had been supplying the electric power consumed at the Ladish Malting Company for nearly fifteen years.

Installed in 1951, the modern 2500 kw WA-Series unit shown here is now on 24 hr a day, 7 day a week duty. It consists of a non-condensing impulse steam turbine and housing type air-cooled generator and exciter . . . carefully engineered and manufactured to operate as an integrated unit.

Built for condensing or non-condensing service in NEMA ratings through 7500 kw, a modern WA-Series unit also will enable *your* power plant to meet tomorrow's expanded power demand. Complete details contained in new Bulletin 03B7654. For your copy, just call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3601

# ALLIS-CHALMERS

A-C ALLIS-CHALMERS

# New equipment and developments

( Continued from page 8 )

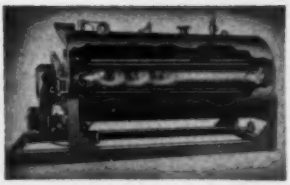
### 7—Cubicle switchgears are factory assembled

Air blast breaker cubicle switchgears for both indoor and outdoor service, known as Unitype, have been introduced by Brown Boveri Corp. They are factory assembled and completely wired, ready to set on foundations and connect into the circuit. Personnel protection features and absolute freedom from fire and all hazards and inconveniences associated with oil type switchgears are incorporated in the design. An airblast breaker which is built into the cubicle is designed for easy accessibility and convenient parts replacement. The electro-pneumatic control mechanism is assembled into a single unit, removable as a whole. A disconnect operating mechanism, with its air damping system,

is likewise a single unit, easily removed. All parts subject to supervision, inspection or replacement are easily accessible from the front of the breaker. The breakers are available in two types: industrial (isolated phases) and station (segregated phases) with standard ratings from 7.2 to 23 kv, 250 to 1,500,000 mva.

### 8—Steam generator easily installed

The Continental Packaged Steam Generator announced by the Boiler Engineering and Supply Co. is fully automatic and self-contained, efficient and easy to install. One feature is that front and back can be opened in 15 to 20 min, providing ready access for interior cleaning and servicing. This generator is ready to operate when service connections are made. It is available for use with heavy oil, light oil, gas or a combination, and in sizes from 10 to 500 hp, for 15 to 200 psi operating pressures. The unit is an improved two-pass version of the Scotch Marine type boiler. Efficiency is guaranteed to be at least 80 per cent, with steam moisture content under one per cent. Operation of burner can be modulated from 35 to 125 per cent, providing for periodic oversurge when required. The unit is



equipped with the latest automatic controls to minimize operating costs. Burner and fan drive is a standard motor with low hp requirements. The fan used is a forced draft type since it handles only clean air at boiler room temperature.

### 9—Temperature control draws samples

Where to put the thermostatic bulb on a storage type heater or to control any heat exchanging operation has always been a problem. The Aerco heat exchanger control, according to the Aerco Corp., solves the problem by locating the bulb inside a tube which draws samples from the top and bottom of the tank in proportion to the

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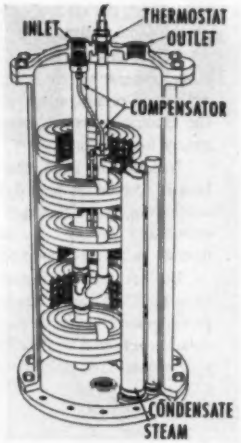
rate of flow, and then mixes them inside the compensator tube. It governs and acts instantly when water is taken off, and controls to within 2 deg on intermittent and ½ deg on continuous loads up to 80 per




cent of the load. For large installations, it may be used as a combination booster and temperature control in series with storage tanks, or shell and tube exchangers. No other temperature control is required on the system. Standard units are made for capacities from 5 to 300 gpm with temperature rises from 5 to 150 F.

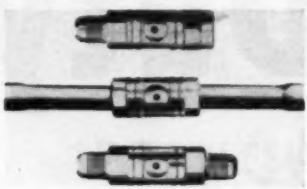
### 10—Fan ventilator has free opening dampers

Designed particularly for rapid localized removal of air contaminated with smoke, fumes, dust and heat, the Burt Free Exhaust Fan Ventilator is announced by The Burt Mfg. Co. The high capacity unit is

powered by an axial flow fan direct connected to its motor. Air shaft extends above the fan and terminates in a pair of dampers that open and close automatically as the fan is turned on and off. Their absolute free opening allows an unrestricted volume of air to be driven vertically upward at high velocity. Seven sizes, with motors from 1/3 to 5 hp, provide capacities ranging from 5000 to 75,550 cfm.

### 11—Flow indicator permits instant visual inspection

A simple, positive and inexpensive flow indicator called the Liquid Eye is available from Allin Manufacturing Co. It consists of a brass housing with a transparent high-pressure Pyrex tube containing a ceramic eye which visually magnifies when the liquid



line is full. The straight-through design eliminates pressure drop. A glass tube spring mounted for shock resistance and the method of seating gaskets against the ends prevents the glass from touching the housing. Each unit is shock pressure tested. Three styles are available in copper tube sizes of ¼, ⅜, ½ and ⅝ in. with male flare ends, female to male flare ends with copper flare insert in the female end, or with solder connections. They are practical for boiler feed water conditioner lines, oil pressure lines, diesel fuel oil lines, refrigerant and other chemical lines, and in similar installations where a quick check of flow is required.

*( Continued on page 16 )*

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THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

# Only Edward Offers Streamlined Flow

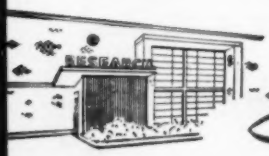
## From 1/4" to 16"....Edward Gives You Streamlined Flow in Globe, Angle, Check, Non-Return, Blow-Off, Gate and Feed Line Valves...in Cast and Forged Steel!

In today's trend to higher pressures and temperatures, with resulting increased erosion, streamlined flow plays an even bigger role in keeping valve operating and maintenance costs down . . . and system efficiency high.

Pioneered by Edward—developed after years of extensive flow tests and experiments with plastic models, prototypes, and much specially designed equipment in the largest laboratory in the world devoted exclusively to steel valve research—Edward *Streamlined Flow* offers these four outstanding advantages.

1. Reduces wear-producing turbulence—giving longer life to seat, disk, and other moving parts.
2. Lower pressure drop.
3. Delivers maximum flow where needed.
4. Often permits use of smaller pipe and valve sizes.

With Edward's broad range of valve sizes and types with streamlined flow, you can get peak valve operating efficiency . . . all-across-the-board, *wherever* valves are used. *A product of* Edward Valves, Inc., 40 West 144th Street, East Chicago, Indiana.




Edward ...BIRTHPLACE OF BETTER VALVE DESIGNS

# —IN A FULL RANGE OF VALVE SIZES

These illustrations show wear-reducing Edward streamlined flow in both small and large valves. Small valve demonstrates straight through, full flow channel of Edward Univalve. Large valve is Edward globe stop valve . . . note smooth, economical flow pattern.

**FEATURES LIKE THIS SAVE YOU MONEY**

*That's why it pays to specify Edward Valves*

Another Product

## Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

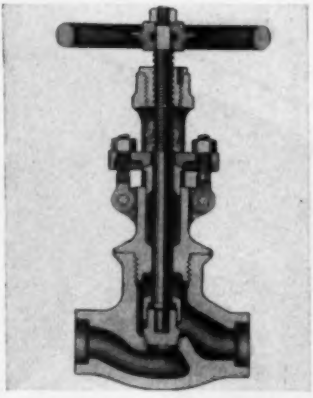
EAST CHICAGO, INDIANA

# New equipment and developments

*( Continued from page 12 )*

### 12—Valves feature bonnet joint

An unusual line of small steel valves for high-pressure, high temperature services has been announced by Crane Co. Globe and angle patterns are currently available in both 1500 and 2500 psi classes, and in ½ to 2 in. sizes, with either socket-welding or screwed ends. They are especially recommended for use in power plants on main steam, auxiliary steam, boiler feed and other piping, and for drips, drains, by-pass, blowdown and similar services. Distinguishing feature is the Lip-Seal bonnet joint. It provides absolute joint tightness, freedom from maintenance, and minimum weight and bulk, yet it can be easily dismantled and reassembled. The joint consists of long body-bonnet threads which are pulled up until contact is made between the flat surfaces on the shoulder of the bonnet and the top of the body. The small lips around the edge are then seal welded. The valves also have a disc-



stem connection that is entirely new in design. It retains the highly desirable swivel feature but eliminates all avoidable looseness of parts. This minimizes the opportunity for disc vibration which sometimes occurs, especially where high velocities are encountered. Seating surfaces of the plug type seat and disc are faced with Stellite. The seat is integral with the body. Stuffing box is unusually large and deep, holding from 9 to 11 rings of high grade packing. Two piece ball-type gland, and swinging type gland eye-bolts are used.

### 13—Controller anticipates temperature changes

A proportioning indicating pyrometric controller, called Model JP Gardsman, is being manufactured by the Taco West Corp. It automatically adjusts the ratio of power "on" and "off" over a given time-cycle to maintain any desired temperature. According to the manufacturer, the controller anticipates and corrects for thermal inertia by preventing control point overshooting on

most installations, with a subsequent improvement in production and lowering of operating costs. The proportioning action takes place in the controller section of the circuit and does not affect the reading of the temperature indicating pointer. The pointer therefore indicates the accurate temperature at all times. The controller is available in 36 standard scale and thermocouple ranges, and is powered by 115 or 230 v, 60 c current.

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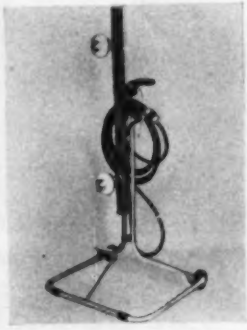
### 14—Branch circuit extensions provide portable power

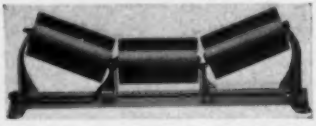
Portable branch circuit extensions which literally roll power, light or heat to any location for industrial maintenance work, temporary assembly lines, construction jobs or underground work have been announced by National Electric Products Corp. Known as NE Rolla-Duct, the devices are collapsible and portable. They are provided with a power and light head as shown, a strip of



flood lighting or a strip of infra-red heating units. Approved rating is 20 amp at 115 or 220 v. The portable assembly consists of a 46 in. strip of No. 1700 Surfaceduct which is swivel-mounted on an all-steel tubular carriage. The duct locks into any horizontal or vertical position. It may be elevated to a height of 5½ ft, or the carriage may be collapsed to roll under jobs. Light and power can therefore be furnished to any desired point. Engineered for complete electrical safety, the strips are fully grounded and are provided with a circuit breaker incorporated in the strip.

### 15—Conveyer idler greasing design is improved

An improvement in greasing design for belt conveyer idlers is announced by Chain Belt. Rigid steel grease piping has been replaced by reinforced flexible automotive type grease tubing, which will take higher gun pressures and will not be broken off in shipment. The flexible sections are made in lengths which allow them to "hug" the



inside of the inverted angle or channel base. Grease tube extension to the far side is accomplished by threading a flexible section through the base to the grease fitting at the near side. Location of the grease fittings has also been changed so as to be more accessible, permitting safe servicing at any time. The fittings are protected during shipment of the idler base.

### 16—Ducts have all-plastic construction

Duct systems made of tough, corrosion-resistant plastic are being manufactured by the Mechanical Goods Div., United States Rubber Co. Tanks, liners, trays, hoppers, feeders, fume exhaust hoods, washers, stacks, fume troughs and gutters are being specifically engineered for the handling of acids, alkalies, aliphatic hydrocarbons and other basic chemicals. A processing tank hood to handle sulfuric acid mist is shown in the

illustration. A blend of styrene plastic and acrylonitrile rubber as the major construction material combines the three desirable properties of dimensional stability, toughness and chemical resistance. It is marketed under the trade name Uscolite. The equipment is entirely plastic. Reinforcing ribs, joints and corners are extruded from the plastic and sheets used to form the sides, tops and bottoms of the ducts are of the same material. Rivets are injection molded from the plastic while bolts are machined from extruded tube stock. Joints are solvent welded with a solution of the same plastic to form an air-tight assembly. The company states that the finished ducts are cheap, durable and easy to install.

*( Continued on page 18 )*

Any way you figure it, corrosion of steam and condensate lines is a serious problem . . . and a costly one! Replacement of corroded lines, interrupted production, increased labor and maintenance send costs spiraling far beyond the limits of economical plant operation. But something can be done about it *right now*, with complete assurance of satisfactory results.

Take the case, for example, of a large plastics molding plant which operated the cycle on its molding machines alternately with steam and oxygen-saturated cooling water. Under these conditions, severe corrosion resulted. Check valves on the steam supply lines to the machines had an average life of only one week—*sometimes even less!* Costs were skyrocketing.

Here's what Betz did about it. By applying its patented filming amine treatment, piping and valve losses stopped *immediately!* After three years' treatment with this advanced technique, satisfactory corrosion control continues. What's more, plant records show savings in labor and maintenance have averaged 30 times the cost of the treatment applied.

This is just one example of how Betz Engineers help keep plants *like yours* at peak operating efficiency. Why not get in touch with Betz today as the first step toward solving your particular water problems. There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

*For the full facts and figures on how BETZ is solving return line corrosion problems in plants like yours, write today for Technical Paper No. 124.*

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

# New equipment and developments

*( Continued from page 16 )*

### 17—Electrometer features versatility

An improved electrometer, designated Model 200A, is announced by Keithley Instruments. More closely overlapping scale ranges and greater accuracy are possible than with the company's previous model. It has two scale ranges, 0-2 and 0-8 v, and a separate zero center scale is provided to make zero center readings easy. Two voltage dividers with ratios of 10:1 and 100:1 can be clipped over the guard ring to make five ranges available; 0-2, 0-8, 0-20, 0-80 and 0-200. Extreme versatility is claimed for the new instrument, especially when used with

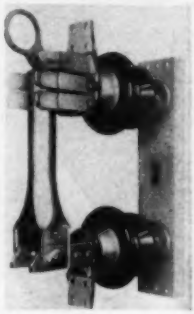
its accessories. Quick conversion to a micromicroammeter is accomplished with a series of shunts which are accurate within 1 per cent, and clip over the guard ring. Insulation and capacitor leakage current and resistance can be measured in this manner. Addition of a test voltage supply results in a highly sensitive megohmmeter which reads resistances up to $10^{16}$ ohms. It also can be used as a voltmeter where only very small currents can be drawn from the source and for measuring one ampere current or less.

### 18—Cleaning compound non-conducting

Magnus Chemical Co. announces a steam cleaning compound, Magnus 72, a liquid concentrate which contains no alkaline salts. This removes the hazard of electrical conductivity of the solution and residues. This compound is neutral in reaction, and will not dull or streak any good paint. It is non-corrosive for the same reason, and aluminum and other soft metals are not affected. It is safe for operators, with no hazard of skin contact, and it generates no objectionable fumes. Another feature is that it does not clog steam cleaning equipment, due to its unsaponified oil content, which works to prevent rust formation on unprotected metal surfaces.

### 19—Disconnecting switch is hook operated

Delta-Star Electric Co. announces a line of B-2K outdoor hook operated disconnecting switches. These switches feature high pressure silver to copper contacts, hard drawn copper tubular blade, and an overall design providing superior electrical and mechanical characteristics. Blade pryout and lock design insure smooth positive operation under all conditions. At the clip



end, contact is made by the blade operating against silvered copper hinge bars. Phosphor bronze spring cup washers maintain constant pressure on the silvered bars. The switch is available in all standard voltage ratings from 7.5 to 161 kv and in ratings of 600 and 1200 amp, for upright, inverted or vertical mounting.

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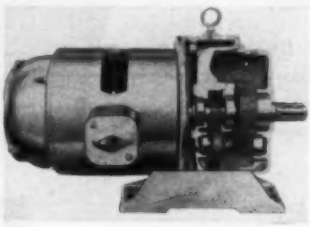
### 20—Gear reducer has internal fluid coupling

Standard motors and a gear train designed into a single compact unit has been announced by Reuland Electric Co. The purpose of the unit, known as Motoreducer, is



to convert a motor's conventional high-speed into a slow-speed, high torque output. An integral fluid coupling provides cushioned starting of heavy loads and protection against jamming of equipment. Ideal applications are cranes, conveyers, dryers, mixers, car pullers and other machinery where heavy loads require smooth acceleration at reduced speeds. Power take-off shaft, gears and bearings are located immediately adjacent to the vertical centerline of the strong pyramidal base. Load pull is thus transmitted directly to the base, minimizing any lateral stress. Helical gears, operating in an oil bath, are hobbed from special alloy steels. The units are available with squirrel cage, fluid shaft or slip ring driving motor, either polyphase or single phase. Gear train can be either single or double reduction and all are available in either drip-proof or totally enclosed designs. Output speeds are from 1 to 600 rpm in a wide range of ratings.

### 21—Clamp holds bus-drop cable

To meet the need for a fitting suitable for bus-drop cable, a quarter-bend cable clamp, the Sky-Tie, is being manufactured by the Adalet Manufacturing Co. Many plants have been using bus-drop cable with conduit as a simplified means of transmitting power to machine tools from bus duct. The method permits quick installation and ready

rearrangement of machines. It is both a supporting clamp for suspending cables above machines and a fitting which will anchor cable at the busway and machine. Two identical pieces form the device, joined by two heavy bolts. Installation is merely a matter of tightening these bolts with the support in position. A spring fits onto the device tangentially to its bend and ties back to a structural member to absorb vibration and shocks.

### 22—Lubricant can be applied to wet wire rope

Due to unusual penetration and adhesion properties, a wire rope lubricant known as Texaco Crater A will permit application to wet wire rope, according to The Texas Co. Extensive field tests indicate that this lubricant achieves greatly improved wettability while retaining all the desirable characteristics of the product previously marketed under the same name. Field tests of cables on dredges and cranes indicate that the compound is especially valuable for use in severe weather conditions where the wire rope is wet when the lubricant is applied, or where cable is subjected to abnormal water conditions. It is a thin liquid product which remains pliable under a wide range of atmospheric conditions and can be applied without heating. It will not drip or evaporate in hot weather and does not harden or chip in cold weather.

***( Continued on page 23 )***

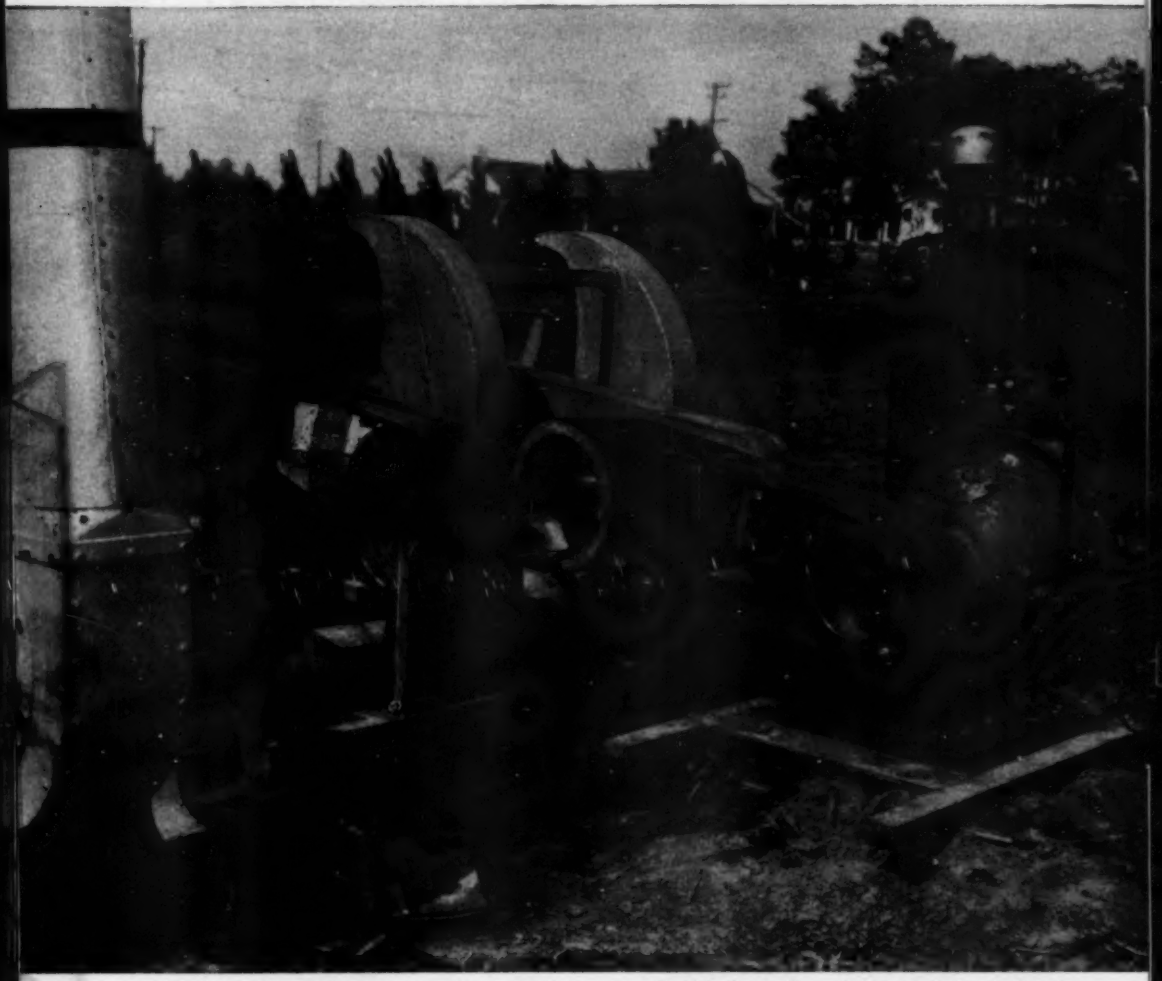
# B.F.Goodrich GROMMET BELTS AT WORK

*Cylinder saw cuts two ways at once—but work often had to be stopped for belt dressing or other "first aid".*

## Saw bites on a curve

As fast as men can feed in logs, this cylinder-shaped saw cuts curved staves for drum-type distillery kegs. A diesel engine runs the saw by means of belts. When the tough oak logs hit the saw there's a jolt. This shock hits the belts so hard that flat belts couldn't take it. They stretched and slipped. Work often had to be stopped while belt dressing or other "first aid" was applied. This was a costly problem—but grommet V belts solved it as shown on the following page.

# Cylinder saw (continued)



*When tough oak logs hit saw shown on preceding page, there was such a jolt that ordinary belts stretched and slipped.*

B. F. Goodrich grommet V belts solved the problem described on the preceding page. Reason: grommet belts stand the 8-hour daily shock treatment as the saw bites into hundreds of oak logs. The grommet belts don't stretch and slip; maintenance time and replacement costs are now way down. And the operator says the men at the saw are safer—no danger of BFG grommet V belts breaking as flat belts sometimes did.

### *20 to 50% Longer Life*

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V

belt. Belts last 20 to 50% longer, depending on service. (The more severe the service the greater the increase over ordinary belts.)

### *What is a Grommet?*

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

### *All Cords Put to Work*

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet V belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

### *Better Grip, Less Slip*

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

### *They Cost No More*

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U.S. Patent No. 2,233,294).

# No more shutdowns

These belts drive a rock crusher that's set in the face of a cliff. It's a hard-to-get-at place that makes shutdowns extra costly. So belts must run trouble-free in spite of abrasive rock dust and the jolting punishment they get from the crusher.

Ordinary V belts previously used gave trouble because of slippage. B. F. Goodrich grommet V belts now used have been in service well over 2 years. Grommet belts eliminated the slipping; improved stopping and starting and have run completely trouble-free.

*Cliff dwelling rubber bands at West Lake Quarry and Material, Inc., Florissant, Mo.*

# B.F.Goodrich GROMMET BELTS AT WORK

## No vacation allowed

Wichita's Kansas Milling Company makes a malted flour that requires a cool plant. The cooling equipment—and belts which drive it—must perform around-the-clock, no time off.

B. F. Goodrich grommet V belts were selected because other types of belts had required frequent maintenance involving shutdowns. The grommet belts have justified the choice; operated constantly for over three years, eliminated slippage and loss of production due to belt troubles.

The grommet V belt is a typical B. F. Goodrich improvement—a money-saver that does jobs better in industries of all kinds. Good reasons why it will pay you to get in touch with your BFG distributor when you need V belts.

*Belts help cool down Kansas summers!*

**These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.**

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

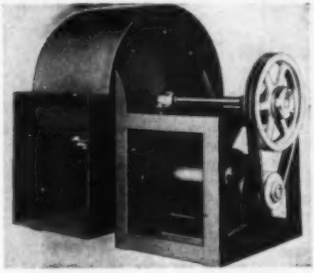
*The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio*

# New equipment and developments

*( Continued from page 18 )*

### 23—Blowers are produced in new sizes

Several new sizes of belt drive utility blowers are being produced by The Peerless Electric Co. These include smaller units for use in electronic cooling and larger units for general drying, exhaust, ventilation and



air driven conveyer systems. Sizes now range from 9 to 30 in. dia wheel, with ratings from 1/6 to 7½ hp. Special features include adjustable pulley speeds, vibration dampeners, weatherproof covers and interchangeable motors. Standard acid resistant finishes can be furnished.

### 24—New cloth filters gases to 550 F

One of the discoveries resulting from the intensive research of the Los Angeles Air Pollution Control Program to eliminate from the atmosphere eye and nose irritating dust is a new filter bag for use by heavy industry to filter gases at temperatures never before possible. The new bag, made of MACO silicone-impregnated glass cloth manufactured by Menardi & Co., will filter gases with a temperature range up to 550F. Its smooth silk-like texture and great flexibility make it easy to clean and economical to use.

### 25—Plastic batteries are light weight

Gould-National Batteries, Inc., announces a line of plastic batteries for use in alarm systems, power plant control systems and applications where batteries are used for stand-

by emergency power. They are available over a wide capacity range from 10 to 100 amp-hr, at the 8 hr rate of discharge. The containers of polystyrene are 40 per cent lighter in weight than conventional containers, are smaller in over-all dimensions, do not react with electrolyte, are transparent, and have better shock resistance than glass.

### 26—Tachometer features high accuracy

Accuracy to ¼ per cent of any speed being measured is claimed for a tachometer now available from Metron Instrument Co. Uses include such precision speed measuring applications as turbine overspeed tests, production motor test stands and dynamometer test stands. Accuracy is sustained, even under adverse external conditions, by simple cali-

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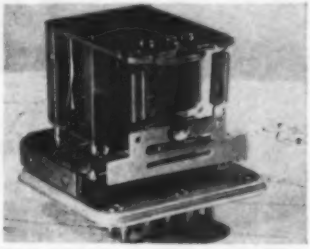
bration adjustments conveniently mounted on the instrument front. Ten overlapping and adjoining ranges, instantly selected by rotary switch, provide more than a 10 to 1 spread in speed. The indicating meter has three scales selected for good readability of minor divisions in integral numbers. Speeds of 36 to 100,000 rpm are easily covered by

three models. The pointer, which is suspended in jeweled pivots, is the only moving part. No damage results from selection of the wrong range or by overspeeding 2 to 10 times the full scale value on any range. The fixed installation indicator is suitable for panel or bracket mounting, and is mounted in sponge rubber for ruggedness. Hand engagement or fixed installation heads for a wide variety of speed engaging applications are available.

### 27—Electric-circuit controller has large capacity

A compact, universal, electric circuit controller with large power handling capacity is being produced by Electric Regulator Corp. Known as Regohm, the instrument converts low power level signals into control signals of a much higher power level. It is a highly adaptable control which can be utilized in voltage, current or speed regulation and can be adapted to important functions in servo systems. It can be adapted to rotating machinery, line and load regulation, rectification, battery charging, saturable reactors, and close differential relays. The unit is available with 20 standard contact fingers of 1 amp, 12 w capacity, or 10 extra heavy fingers of 3 amp capacity. Fingers may be connected in parallel when control cir-



cuit currents are greater than these values. The coil circuit can be operated from signal sources of widely varied voltages and frequencies. A minimum of 1.5 w is required for the coil current, which is available in impedances varying from 0.01 to 10,000 ohms. The unit operates directly on d-c or 50 to 60 c a-c. Built-in rectifiers can be provided for operation on other frequencies. The unit is 2 x 2 x 2 in. and can be hermetically sealed if required.

### 28—Pump for light fluids has rolling vanes

Milwaukee Hydropower, Inc. has announced a positive displacement pump of compact size. Known as the Magna-Mite, it is suitable for handling fuel oil, gasoline, hydraulic fluid, lubricating oils and other light viscosity fluids. Capacities are from ¼ to 1½ gpm. It is rated at 1750 rpm, but has a practical speed range from 300 to 3600 rpm. Generally similar to vane-type pumps in operation and construction, it has one important difference in that rollers replace conventional vanes. Rolling friction therefore replaces sliding friction between the vanes and the pressure chamber. The pump, which is cylindrical in shape, measures only 2¾ in. long over-all. It is available in constant displacement, adjustable displacement or variable and reversible displace-

ment types. All three types will operate in either direction of pump rotation and in any position. The constant adjustable displacement models are suitable for lubricating applications or pumping fuel oil. In the latter, the discharge volume is adjusted by turning a thumb lever with the pump either rotating or stationary. In the variable and reversible displacement pump, a lever may be used to permit either manual operation or remote automatic control.

*( Continued on page 26 )*

# Revolutionary Performance!

## Riley Boiler Unit gives bonus of 20,000 pounds per hour of steam to Masonite Corporation

Here's the maximum capacity guaranteed to Masonite by Riley Stoker Corporation:

50,000 lb. continuous
60,000 lb. for 15 min. peaks

And here's the Masonite report on performance: "For the past 75 days the average hourly load on the new boiler has been 70,000 pounds with peaks of one and more hours' duration of 75,000 pounds."

This same installation called for a guaranteed air heater gas temperature not in excess of 395 degrees at 50,000 pounds of steam per hour. In actual operation at 54,500 pounds of steam per hour, the air heater exit gas temperature was only 377.5 degrees!

No wonder Riley Stoker Corporation, Worcester, Massachusetts, is so well known among leading plants throughout the nation for the highly efficient performance of its boilers!

**Coppus-Dennis FANMIX Burners Were Installed**

To assure such revolutionary performance, Riley specified Coppus-Dennis FANMIX Burners for its boilers. The exclusive FANMIX action — on *all* Coppus burners, gas as well as combination gas-oil — is the reason for such performances.

**FANMIX : Better Combustion : Better Efficiency : Higher Ratings**

FANMIX burners, with their *revolving orifices*, give violent mechanical mixing and agitation of gas and air and, therefore, instantaneous and complete combustion with *minimum excess air* (5% excess air not unusual).

Furnace space is not required for mixing; therefore, *higher boiler ratings* are easily obtained.

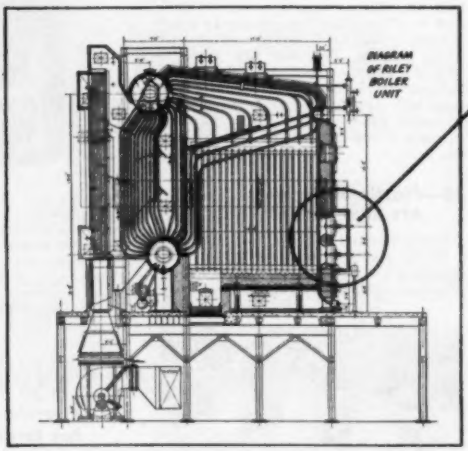
FANMIX burners, with shorter flame than any other burner, cannot cause flame impingement.

FANMIX burners, incorporating a *fan* as an integral unit, have *no draft loss* across the burner. Therefore, regardless of draft conditions, increased ratings are possible.

FANMIX action, with its quick completion of combustion, gives *lower* exit gas temperatures.

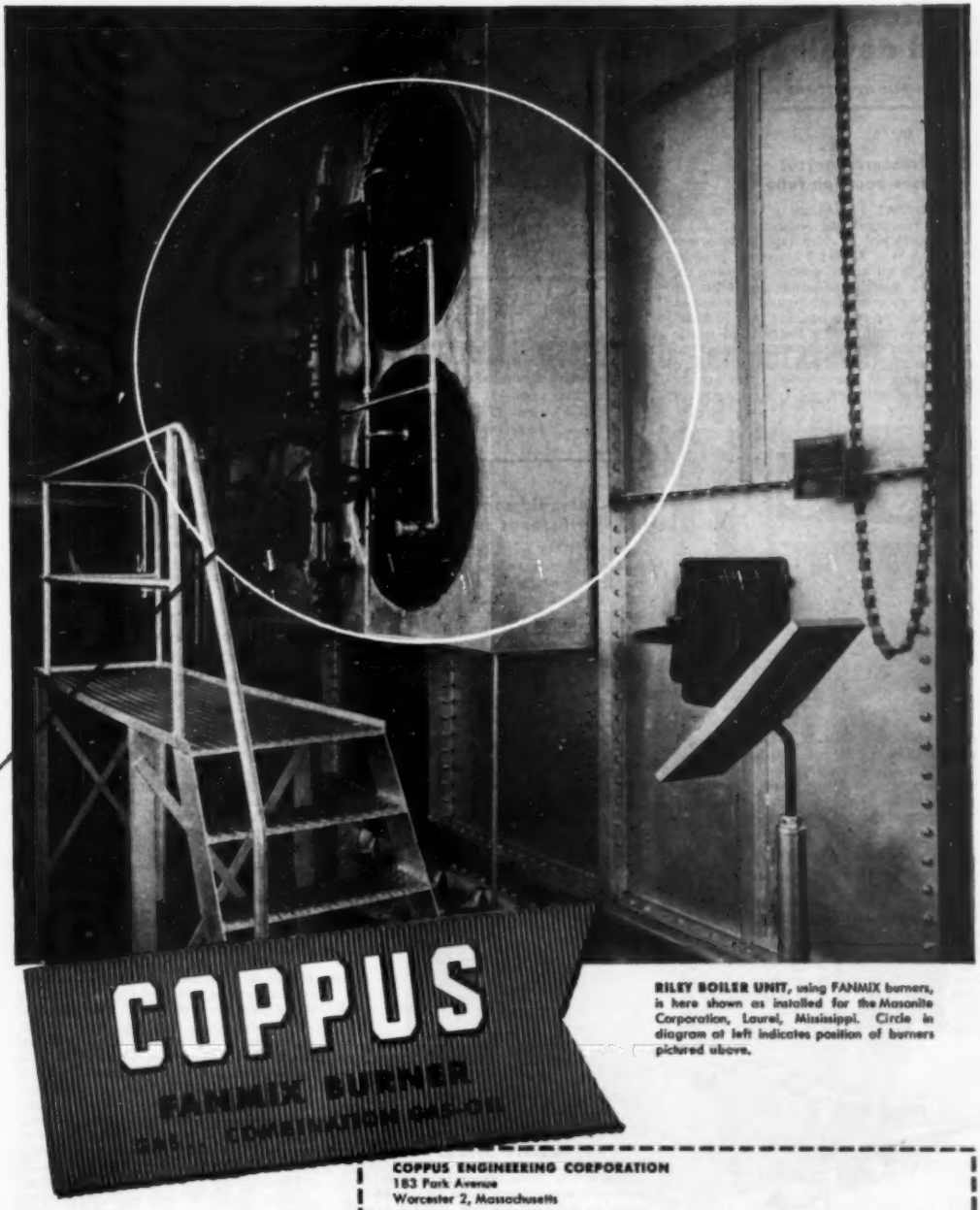
Plan now to take advantage of Coppus-Dennis FANMIX action with your present boiler. Remember — no forced draft equipment nor increase in stack nor increase in furnace volume is required for *FANMIX* operation to get increased capacity. And on *new* boilers, FANMIX lets you plan on reduced combustion space, higher ratings, less stack height or reduced induced draft capacity, and *no* forced draft equipment. Mail coupon today. Sales offices in *Thomas' Register*. Other "Blue Ribbon" Products in *Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory, and Mining Catalogs.*

**JET REACTION** is utilized to rotate fan which is integral part of burner. Automatically proportioned high velocity air passes at right angles through fuel to create ideal mixture for fast, complete combustion and peak efficiency.




**Well-Known Users of Riley Units with FANMIX Burners Include:**

Publicker Commercial Alcohol Co.
Monsanto Chemical Co.
Gaylord Container Corp.
Commercial Solvents Corp.
Celanese Corp. of America
Gulf Power Co.
Mississippi Power Co.
Eagle-Picher Lead Co.
Humble Oil & Refining Co.
Godchaux Sugars, Inc.
Kennecott Copper Corp.
Nicholson File Co.
Bird & Son, Inc.
— and many others




**RILEY BOILER UNIT,** using FANMIX burners, is here shown as installed for the Masonite Corporation, Laurel, Mississippi. Circle in diagram at left indicates position of burners pictured above.

**SEND COUPON** for further information. Coppus engineers FANMIX burners to your individual requirements.

**PLEASE ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD**

**COPPUS ENGINEERING CORPORATION**
183 Park Avenue
Worcester 2, Massachusetts

Please send complete data on Coppus-Dennis FANMIX Burners. I'm particularly interested in
☐ gas ☐ combination gas-oil.

Name..... Title .....

Company.....

Address.....

City..... Zone..... State .....

# New equipment and developments

*( Continued from page 23 )*

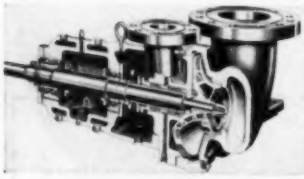
### 29—Pressure control uses bourdon tube

A compact non-indicating pressure controller for regulating control valves has been developed by Minneapolis-Honeywell Regulator Co. Called Honeywell Pressure Pilot, it is for use on process systems in the chemical, petroleum, power and other industries where pressure control is essential. The pilot employs a bourdon tube to measure the pressure and a flapper and nozzle arrangement to produce an air signal directly to the valve. The air signal is based on a change in line pressure. Unit may be mounted directly on the control valve or

on a wall or panelboard. Features of the pilot include an accurate set-point adjustment, changing of control action from direct to reverse in a matter of seconds, and protection of the mechanism from damage by an overload spring arrangement.

### 30—Pump operates at high temperatures and pressures

To pump petroleum hydrocarbons, water and chemical solutions at elevated temperatures and pressures, Peerless Pump Div., Food Machinery and Chemical Corp. has introduced a process pump designated as the Peerless Type PR. Capacities are up to 1000 gpm with heads to 625 ft, and temperatures to 850 F. Horizontal electric motor drive is standard, but others such as steam turbine



or stationary engine can be furnished. The pump's liquid end can be furnished in various materials. Top suction and top discharge or end suction and top discharge are available. Several important design features are incorporated, according to the manufacturer. Center-line mounting maintains pump alignment at any temperature. Positive support prevents strains on the rotating parts, adding to bearing and packing life. Numerous features have been incorporated to prevent leakage. The impeller requires minimum net positive suction head, permitting operation with suction vessels at lower levels without trouble from flashing within the pump. Repelling vanes on the back shroud of the impeller prevent accumulation of solids and reduce stuffing box pressure. Cantilever type bearing housing and spacer type coupling permit complete removal of rotating parts without disturbing piping or driver. The pump is also available with mechanical shaft seal construction.

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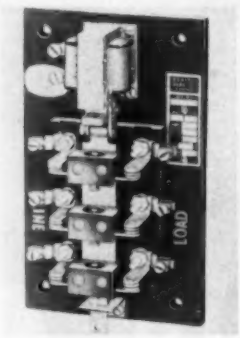
### 31—Solenoid contactor withstands severe loads

Type SC 33 solenoid operated contactor is designed to withstand severe loads based on Type-C lamps, according to the manufacturer, Zenith Electric Co. Constructed on the straight line principle, the solenoid is connected directly to the contact bar. This simplified wiring provides access to any part for quick inspection and service, without



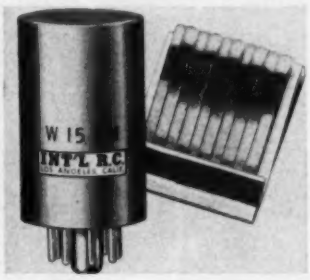

need for disturbing other parts. Use of fine silver contacts is also featured. It is available in either 25 or 50 amp sizes, and can be supplied in any number of poles.

### 32—Concrete paint does not require primer

Smooth-On Manufacturing Co. has announced a new concrete paint for use on interior or exterior concrete, cement block, brick and stone. Known as Smooth-On No. 15, it does not require any primers or sealers and can be applied to painted or unpainted, dry or damp surfaces. One gallon covers approximately 400 sq ft and one coat is usually all that is required. An important feature is its high resistance to water, acid or alkaline attack. Surfaces coated with the product can be washed without damaging the finish. Color is a medium gray.

### 33—Selenium rectifier is hermetically sealed

Hermetically sealed selenium rectifiers in metal cases filled with inert gas and provided with terminals to fit all standard tube sockets are available from International Rectifier Co. This type of assembly has the




advantages of complete protection against corrosive atmosphere, moisture, salt spray, and fungus. At the same time it provides dependable service in applications where quick replacement is essential. The unit illustrated, No. W15CM, is rated at 390 v rms input; 550 v peak inverse; 120 ma, 160 v d-c output at 35 C ambient. Half wave and bridge circuits are also available.

### 34—Tank liners made of polyethylene

Completely welded polyethylene tank liners of removable and stationary type are now offered by the American Agile Corp. Liners of all sizes and shapes with wall thicknesses up to 1 in. are fabricated to customer's specifications. Liners can be furnished with drains, overflows, pipe flanges, fittings and valves of polyethylene, permitting direct connections to other existing pipe lines and installations. Chemical inertness and the welding method employed guarantee a leak-proof liner and reduce maintenance and replacement costs of storage and plating tanks containing corrosive liquids.

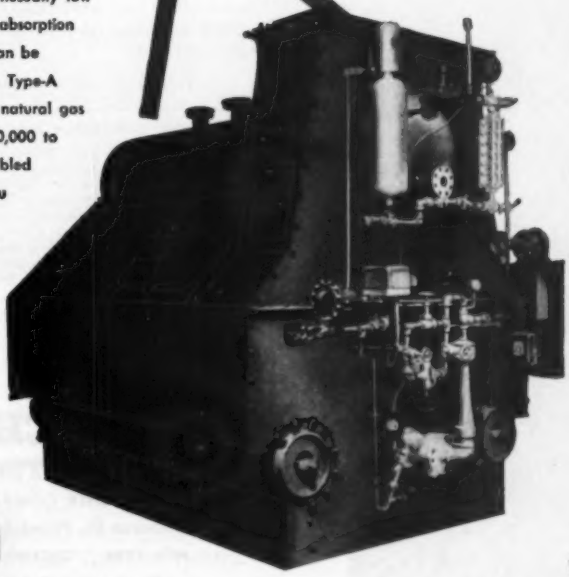
### 35—Phenolic coating has many uses

Availability of phenoline 300, a resin formulation for corrosion resistant coatings, is announced by Carboline Co. The company states that the formulation polymerizes at room temperature in a day's time or less, is completely resistant to caustic soda and bonds directly to almost any surface. The unpolymerized resin fluids contain no solvents and 98 to 100 per cent turn into solid form upon polymerization. When it sets, there is no evaporation of diluents or formation of water — hence no shrinkage in film formation. It can absorb a very substantial amount of filler, used to alter its physical characteristics for desirable heat and impact resistance, without loss of strength. Application can be made by brush, spray or trowel without involving baking operations. Effective corrosion prevention of steel and concrete by acids and alkalies, as well as combinations of these with solvents, can be attained by simple application techniques. Patch and repair work on existing lined or unlined equipment can be made quickly and effectively. Applications include lining

*( Continued on page 29 )*

# high temperatures low pressures with the efficient WICKES type-A dowtherm vaporizer

Wickes Type-A Dowtherm Vaporizer is a compact, efficient radiant heating furnace especially designed for the use of Dowtherm. It is enclosed on both sides by two banks of short, steeply inclined connection tubes that permit operation at maximum temperatures and unusually low pressures without overheating or excessive absorption anywhere in the unit. High temperatures can be accurately and safely controlled. Wickes Type-A Dowtherm Vaporizers, adaptable to oil or natural gas firing, are available in capacities from 750,000 to 20,000,000 B. t. u. per hour—in shop-assembled units up to 6,000,000 B.t.u. per hour. If you are manufacturing petroleum, plastics, paint, food or chemicals or engaged in processing requiring high temperatures, it will pay you to install a Wickes Type-A Dowtherm Vaporizer. Write for descriptive literature or consult your nearest Wickes representative.



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# WICKES

**THE WICKES BOILER COMPANY**
**DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN**

**RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Buffalo • Boston • Chicago • Cincinnati • Denver • Detroit • Cleveland • Houston • Indianapolis • Los Angeles • Milwaukee • Memphis • New York City • Pittsburgh • Saginaw • San Francisco • Springfied, Ill. • Portland, Ore. • Tulsa • Washington, D. C. • Greensboro, N.C. • Tampa, Fla.**

# CONCENTROL STOPS FOAMING

**BEFORE**

Laboratory demonstration shows foaming of highly alkaline solution in test cylinder.

This laboratory demonstration shows — as do scores of successful installations — that Bird-Archer's Concentrol is a highly effective anti-foam agent. It quickly stabilizes alkaline boiler water . . . eliminates foaming action and carryover. With Concentrol, you can forget about bouncing water gages. You get good quality dry steam every hour of every day.

Concentrol is available in liquid, powdered or briquette forms. Special Concentrol formulations are also available containing other commonly used boiler water treatment chemicals such as tannins, phosphates, alkalies, sulfite, etc.

See for yourself how economical Concentrol helps improve steam quality. Your Bird-Archer representative will demonstrate Concentrol in your plant . . . make specific recommendations for its use. Consult him, or write direct to Bird-Archer, outlining the details of your boiler operation.

*FREE DATA SHEET AVAILABLE*

**HOW CONCENTROL WORKS**

Concentrol works by effecting a rapid change in surface tension of steam bubbles which permit coalescence of small steam bubbles into bubbles of larger sizes. This results in the formation of unstable bubble films which break readily upon reaching the steam disengaging surface of the boiler water. This does away with foam build-up and subsequent carryover.

**BIRD · ARCHER**

**WATER TREATMENT**

**THE BIRD-ARCHER COMPANY**

**4337 North American St., Philadelphia 40, Pa.**

NEW YORK · CHICAGO

IN CANADA

The Bird-Archer Co., Limited

503 McGill Building, Montreal, Canada

IN MEXICO

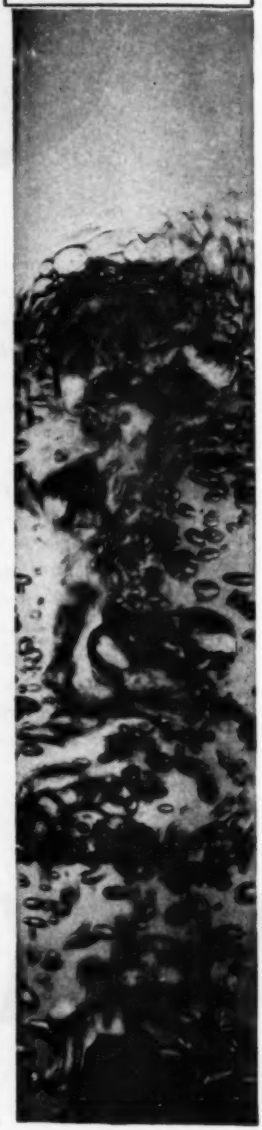
Calderas y Accesorios, S. A.

Amsterdam 291, Mexico D. F.

BA 102

**AFTER**

Same solution after addition of 12 ppm of Concentrol Anti-foam. Constant heat conditions were maintained during test.



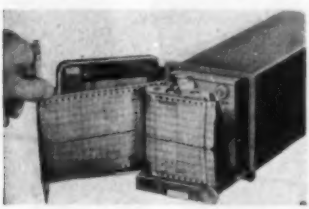
# New equipment and developments

*( Continued from page 26 )*

tanks, fans, hoppers, ducts, pipe, pumps and unjacketed vessels generally, painting structural and process equipment subjected to solvent splash and vapor, sealing porous castings, acid proofing concrete floor troughs, ducts and sumps, and repairing leaks in welded and riveted tanks.

### 36—Recorder pen is electronically actuated

An independently powered miniature strip chart recorder with an electronically actuated pen is announced by the Swartwout Company. Known as the Autronic recorder, it is a graphic indicator for the recently announced Swartwout autronic control system. Unbalance between the primary element transmitter output and the balancing transformer is amplified to drive a rotary-solenoid motor for positioning the pen. Maximum speed is such that the 3 in. chart is traversed in approximately ½ sec. Slowing down pen speed does not reduce sensitivity and accuracy. A three position response-speed adjustment is located in the recorder to dampen out high frequency fluctuation. The pen is



electronically actuated, independent of the chart drive, and measures and records over a range of 0.0 to 0.500 v a-c. The recorder is interchangeable and usable without recalibration for circuits controlling temperature, pressure, level or flow. Plug-in type connections are used for easy removal of the entire unit from the circuit. The recording mechanism can be pulled out approximately 3 in. from the case to allow inspection of past records and to allow inking the pen without interruption of the trace. The unit is extremely compact, measuring only 4⅝ x 5 in. on the panel, and is enclosed in a 14½ in. deep metal housing.

*( Continued on page 32 )*

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Engineered
FOR SAFER AND MORE EFFICIENT REGULATION OF BOILER WATER LEVEL
WRIGHT
BOILER TRIM
new catalog no. 700
WRITE FOR YOUR COPY TODAY
Safety Alarm Water Columns
Low to High Pressure Gauge Valves
Reflex Gauges for High Pressures
Weighted and Compression Type Trycocks
● For 57 years Wright-Austin has concentrated on the manufacture of highest quality steam specialties. Our familiarity with steam users' requirements assures you of thoroughly practical designs in a complete line of Traps (cat. #600), Separators (cat. #500) and Boiler Trim (cat. #700).
WRIGHT-AUSTIN COMPANY
3245 WIGHT STREET • DETROIT 7, MICH.
WA Standard of STEAM USERS SINCE '94

Mr. William Hartfel, Chief Electrician
Trent Tube Mfg. Co., East Troy, Wisconsin
Division of Crucible Steel Co. of America

"By replacing ordinary fuses with Fusetron fuses

# WE WIPED OUT NEEDLESS FUSE BLOWS

"We have a 1200 ampere switch with a grounded neutral on our 220 volt, 3 phase system. To handle the load of approximately 1000 amperes, we used two 600-ampere fuses in parallel.

"These fuses gave us a lot of trouble by blowing two or three times a week. Each blow meant a shutdown that caused a loss in production.

"In the early part of May, about two months ago, we decided to try out Fusetron dual-element fuses.

"These fuses completely wiped out needless fuse blows and what is more important they eliminated the costly interruptions of operating schedules."

## Don't Risk Losses in Your Plant

One **needless** shutdown — One **lost** motor

One **destroyed** panel or switch

One **burned out** solenoid

May cost you more than replacing every ordinary fuse with a FUSETRON dual-element Fuse.

But, simply knowing that FUSETRON fuses do save money is knowledge — but it isn't action.

By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses, you have action that begets money saving.

# Fusetron DUAL ELEMENT Fuses

## *Provide* NOT ONLY SHORT CIRCUIT *But* 10 Point Protection

1. Protect against short-circuits.*
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating—lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

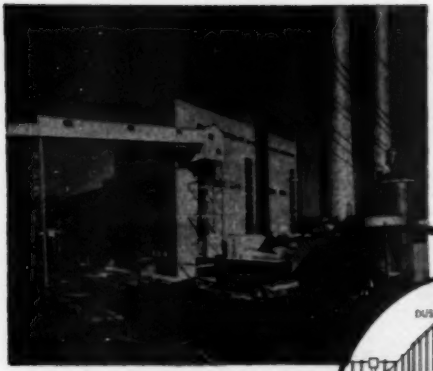
*Fusetron fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

*Send the Coupon for more facts*

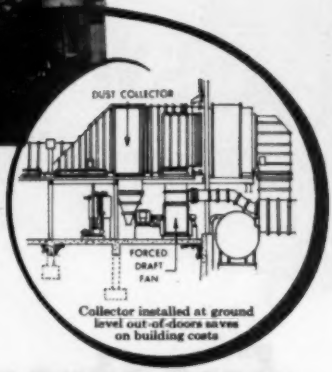
Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.)
Please send me complete facts about FUSETRON dual-element Fuses.

Name _____ Title _____
Company _____
Address _____
City & Zone _____ State _____ 352

(Fusetron is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)



Titus Station
Metropolitan Edison Co.
Reading, Pa.




Collector installed at ground level out-of-doors saves on building costs

**Answer *your* specific dust control problems with an**

AEROTEC

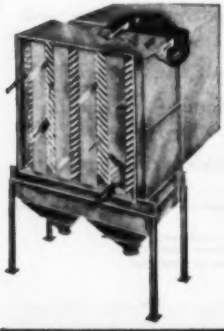
# DUST COLLECTOR
## exactly tailored to your needs

Here is one of the many instances in which the Aerotec Design 3 RAS Dust Collector proved its high efficiency so conclusively that Metropolitan Edison purchased a third unit. Gilbert Associates Inc., of Reading, Pa., were designers and constructors. Three bituminous coal-fired steam generators at this modern power plant, will be equipped with Aerotec Collectors. Layout and breeching are so designed that an Aerotec electrical secondary can be added at a future date without loss of the initial investment.

This mechanical collector, with its multiple, small-diameter tubes, offers you the advantages of high dust recovery in the ultra-fine ranges, even at partial load. The tubes are permanent mold aluminum castings of absolute uniformity. This construction provides the smooth inner wall necessary to ultra-fine dust collection. Tubes are assembled at the factory in lightweight "building block" sections. These assemblies permit flexible arrangement to suit your needs, with the economy of standard construction.

Let our engineers bring to your problems the benefits of their long experience in the field of flyash collection. No obligation.

**Typical Inlet and Outlet Variations**



Catalog 601 gives you complete details on standard and special Aerotec arrangements, plus other useful data on dust collection. Call or write for your copy today.

*Project Engineers*

**THE THERMIX CORPORATION**
GREENWICH, CONN.
(Offices in 38 Principal Cities)
*Canadian Affiliates:* T. C. CHOWN, LTD.
Montreal 25, Quebec — Toronto 3, Ontario

**THE AEROTEC CORPORATION**
GREENWICH, CONN.


# New equipment and developments

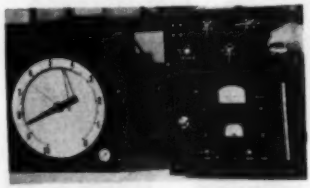
*( Continued from page 29 )*

### 37—Oxygen indicator requires minimum maintenance

An improved version of oxygen indicator, designated Type C-2, has been introduced by Mine Safety Apphances Co. It is said to be more easily operated and maintained than previous models manufactured by this company. The only maintenance required is the periodic replacement of the carbon electrode, addition of an ounce or two of oxylite to the detector cell approximately every two weeks, and replacement of a No. 2 flashlight dry cell every week. The instrument measures the oxygen content of inert and combustible atmospheres in chemical, metallurgical, and petroleum industries. It has a variety of industrial applications such as measurement of combustion efficiency and measurement of oxygen content in fuel gases for improving safety of utility operations and controlling pipe line corrosion.

**TO REQUEST ADDITIONAL FREE DATA**

**Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 131. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly**



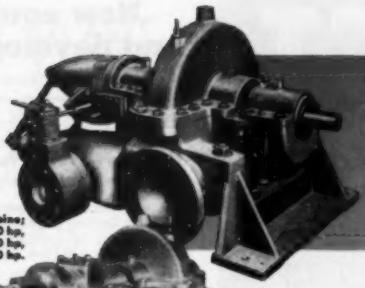
Scale ranges including 0-1, 0-5, 0-10 and 0-25 per cent are available. An integral, large-size meter having 50 scale graduations makes possible direct readings to within 2 per cent of the selected scale range.

### 38—Lubricant protects at high temperatures

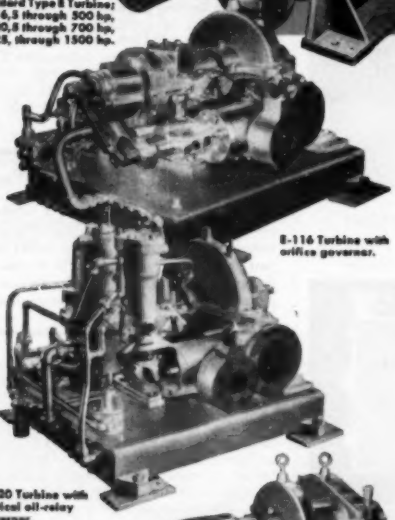
A premium anti-friction bearing lubricant, Texaco High Temp grease, which extends the efficient range of operation of ball, roller and plain bearings at high temperatures, has been announced by the Texas Co. It exceeds established military and industrial standards in affording unusual protection at temperatures up to 300 F for continuous operation and 350 F for intermittent operation. The grease has excellent oxidation resistance, and similar desirable characteristics for high temperature operation. Water resistance makes it applicable where long retention of grease and resistance to washing out are factors.

*( Continued on page 34 )*

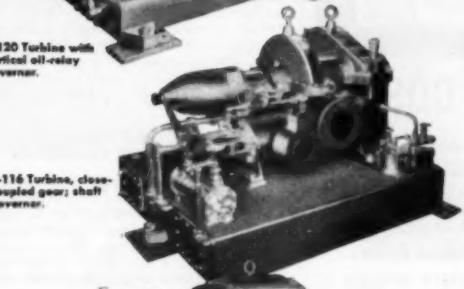
# Take the *Guesswork* out of Turbine Selection!



Standard Type E Turbine;
E-116,5 through 500 hp,
E-120,8 through 700 hp,
E-125, through 1500 hp.



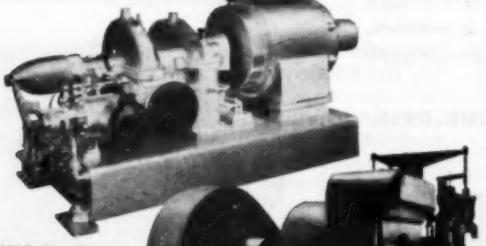
E-116 Turbine with orifice governor.



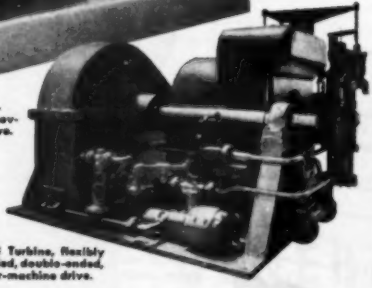
E-120 Turbine with vertical oil-relay governor.



E-116 Turbine, close-coupled gear; shaft governor.



E-120 Turbine, close-coupled gear; shaft governor—generator drive.



M-25 Turbine, flexibly coupled, double-ended, paper-machine drive.

Westinghouse General-Purpose Turbines can be supplied for mechanical or generator drive . . . either direct connected or geared . . . for condensing or noncondensing operation. This *complete* line . . . plus a nationwide staff of trained steam engineers, conveniently located sales offices, and service shops . . . assures you of the correct solution to *your* steam-drive application problem.

The single-stage Type E turbine, with designs for three basic classes of steam conditions, three wheel sizes and three standard governor types, provides in effect twenty-seven *standard, economical* variations to cover a wide range of applications. In addition, an almost limitless number of special applications can be met through the use of heavy-duty parts, and optional accessories.

Geared-turbine drives are offered either flexibly coupled to accommodate either right- or left-hand gear offsets, double-ended output shafts; or close-coupled (Gearturbines). Gearturbines are standardized on a single offset arrangement, affording utmost economy.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multi-stage units for applications requiring high temperatures and pressures, higher speeds, greater horsepower, extraction for process applications, or higher efficiency than may be had with single-stage machines.

The superiority of the Westinghouse line is the result of over 60-years' design, manufacture, and application experience. To get the benefit of this broad know-how, call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50532

YOU CAN BE SURE... IF IT'S

**Westinghouse**

**GENERAL-PURPOSE TURBINES**

# COMPACT

within arms' reach

# MORE STEAM

## in LESS SPACE... at LESS COST!

The Clayton Forced Recirculation Steam Generator produces more steam per pound of weight and per cubic foot of space occupied than any boiler known... and at less cost. Fast steaming, automatic and safe, the Clayton Generator sets a new standard of efficiency for the production of processing steam. It is the only steam generator with a cost curve that parallels the load demand curve through all stages of operation. Each unit... 15 to 100 h. p.... is complete, ready to connect and operate upon delivery. No burners, pumps, instruments or accessories to buy.

**THIS COUPON BRINGS PROOF TO YOUR DESK**

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

IP-3

CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

NAME_____
FIRM_____
ADDRESS_____ STATE_____
CITY_____

Clayton
MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA


# New equipment and developments

*( Continued from page 32 )*

### 39—Converter is for low-level d-c signals

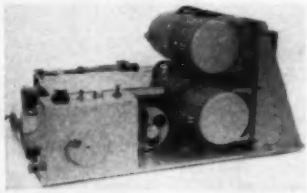
A small magnetic converter designed for use in converting low-level d-c error signals to a-c voltage in a wide variety of measurement systems has been announced by General Electric's Meter and Instrument Dept. The new magnetic amplifier type device, weighing only 3 oz and encased in the metal envelope of a standard 6L6 radio tube, can be used wherever precise control is required from small d-c signals. Uses listed include applications in industrial measurements, numerous servomechanisms and electronic control systems. Hermetically sealed, it can be operated efficiently under extreme conditions of temperature, pressure and humidity. Because of its stability, low temperature rise and complete lack of moving parts, the converter will operate continuously and reliably over long periods of time.

**HOW TO REQUEST FREE BULLETINS**

**Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 131. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly**

### 40—Oscillograph operates under unusual conditions

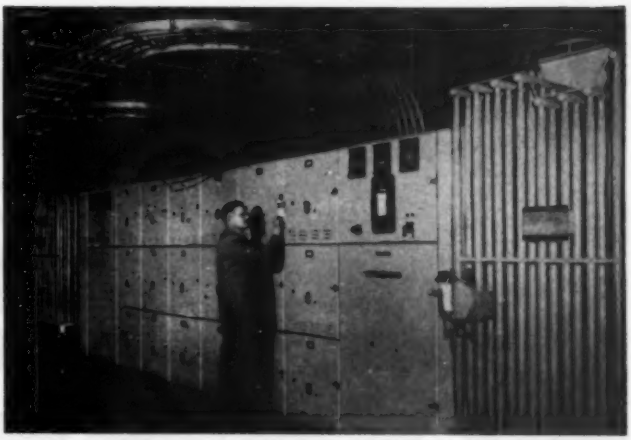
Direct recording oscillograph and amplifier systems in both bench and mobile assemblies are now available. These units are of rugged construction and conform in most respects to JAN requirements for such equipment. Features include a stylus motor system which permits operation in any plane, and under



vibrational and atmospheric conditions which have previously limited or prohibited use of this type of equipment. These units have many applications in the direct measurement field and can be used in a wide variety of measurement problems including vibration, stress, displacement and acceleration analysis. They are also finding acceptance in telemetering systems. The mobile 4 and 6 channel units are compact and have a minimum number of controls. Unit chassis design in each dual channel d-c or a-c/d-c amplifier permits simplicity of operation.

# TANK PLANT GETS ROLLING IN RECORD TIME

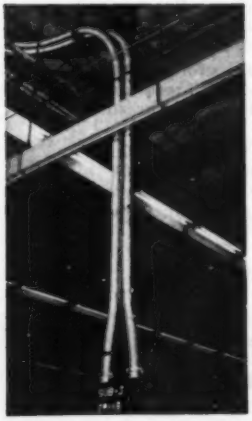
## ... with G-E Interlocked Armor Cable



**FROM WAREHOUSE TO TANK PLANT** in less than a year. That's the latest record of this midwest tank plant. This 53-acre tank plant was sped into production with flexible, adaptable G-E interlocked armor cable installed on Stacey aluminum racks.

**INSTALLATION SPEED** was a real advantage on main-feeder runs. Racks were quickly hung from ceiling and cables were pulled into place. There was no need to fit raceways and pull cables through.

**TERMINATIONS AND SPLICES** were bolted into position without delays — without expensive lead joints normally required in other types of installations.



**NO THREADING, NO PRE-BENDING** required on this run. Hours of bending time were saved on this secondary circuit. Threading and fitting at panel box were eliminated.

**COMPLETE DATA ON ADVANTAGES**

Get the story on installation speed with G-E interlocked armor cables from booklet 19-320. Write Section w11-344, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

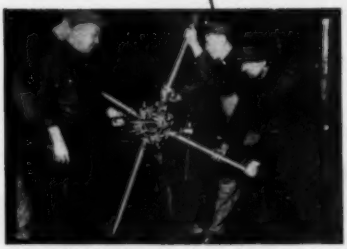
*You can put your confidence in—*

**GENERAL ELECTRIC**

TOOL UP FOR PROGRESS

with TOLEDO

...Leader in Pipe Tools for Years!

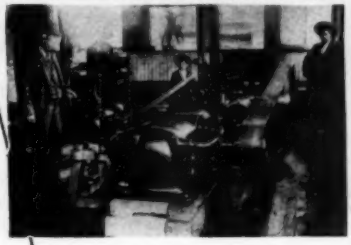


Threading 3" pipe was a slow, tedious job with this old-time device (not a Toledo).

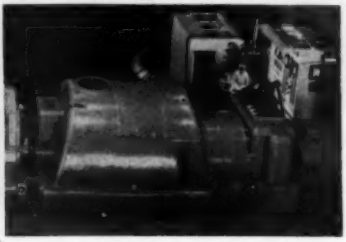
Today, 4" pipe can be cut off, reamed, threaded in close to a minute using Toledo No. 1-2-4 machine.

•

Electric power plant in Toledo, Ohio, fifty years ago . . . employed small engine-driven direct current generator to serve a few carbon arc lamps.



Turbine-driven 75,000 watt machine is part of this city's power system today . . . served by threaded pipe for conduits, water, steam.



Fifty years ago . . . in the days of Henry Ford's first car and the Wright Brothers' flight . . . a revolutionary new principle in pipe threading was discovered by W. W. Vosper, inventor of Toledo Pipe Tools and now Chairman of the Board.

This was destined to ease the work and save time of mechanics for years to come. Instead of solid dies, segments were used with only enough teeth on their cutting edge to form a thread—thus reducing friction. Also, as the thread was cut the dies receded—thereby further relieving friction.

This was the beginning of Toledo Pipe Tools in 1902 . . . the Leader in its field since the very start. Today—better mechanics from coast to coast prefer TOLEDO hand tools and power pipe machines . . . to *speed the work* and *reduce costs!* Write for new catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

Toledo Simpact, self-contained, 1" to 2" threader.

Toledo No. 999 2" Power Pipe Machine.

RELY ON THE LEADER

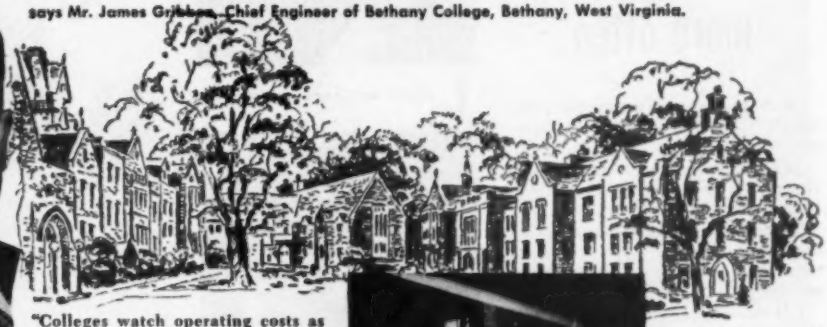
TOLEDO PIPE TOOLS...

POWER PIPE MACHINES...POWER DRIVES

# "We 'educated' our College Heating Plant...

## with a modern coal installation we saved more than a third of our fuel bill,"

says Mr. James Gribbon, Chief Engineer of Bethany College, Bethany, West Virginia.



"Colleges watch operating costs as closely as any business firm—and one big item for our college is the heating bill. That's exactly why Bethany went to the expense of putting in new coal heating equipment! Our old system supplied heat for sixteen buildings—to the tune of 2,600 tons of coal a year. Our new installation, with its automatic stoker, does the same job using only 1,650 tons. That's a fuel saving of 38.9%! Our eyes certainly have been opened to the efficiency and economy of *bituminous* coal—especially when it's burned with modern equipment."

Here's Bethany's new boiler room, showing the pipe of the automatic stoker. **THIS MODERN EQUIPMENT WILL PAY FOR ITSELF, THROUGH FUEL SAVINGS ALONE, IN LESS THAN TWO YEARS!**

Modern combustion installations can add anywhere from 10% to 40% to the energy obtained from the same amount of coal in years gone by. Great advances have been made in coal- and ash-handling equipment, too—cutting labor costs—making coal as clean and convenient to use as any fuel.

If you're planning to modernize your present installation—or thinking of building a new plant, call in a competent consulting engineer. He'll show you how a modern coal system designed to meet your specific needs can save you money and serve you better!

And don't forget—you'll always be able to get the coal you need. America's coal industry is the most efficient in the world. America's coal reserves are ample for centuries to come. Right now and for the future, too, coal users can be assured of a dependable fuel supply at reasonable prices.

**BITUMINOUS COAL INSTITUTE**
A Department of National Coal Association
**Washington, D. C.**

**If you're running your own steam plant—for heat or for power—you just can't afford to ignore these facts!**

**COAL** in most places is today's most economical fuel.

**COAL** resources in America are adequate for all needs—for hundreds of years to come.

**COAL** production in the U.S.A. is highly mechanized and by far the most efficient in the world.

**COAL** prices will therefore remain the most stable of all fuels.

**COAL** is the safest fuel to store and use.

**COAL** is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

*FOR HIGH EFFICIENCY ★ FOR LOW COST*

# *YOU CAN COUNT ON COAL!*

# So much easier... It's used more often

More people use Worthington's QD sheave than any other . . . because it's *easier*.

It's the only one on the market that gives you the choice of mounting in two pieces or preassembled.

It's the only one that makes switching sheave sizes really easy—the hub stays put, there's no realignment problem.

It's the only one with a *lock* to keep the shaft key from drifting.

You'll find it's *stronger*, too. Worthington is the only manufacturer to design each size individually for the load—rather than to proportion all sizes from one design. I-beam spokes carry heavier load with less weight.

Put Worthington QD on your drives and take a load off your men. Hubs and sheaves are available in a wide range of sizes and HP.

Worthington distributors carry complete range of stock sizes. The QD design is also licensed to other sheave manufacturers with dimensions standardized for interchangeability.

Write for Bulletin V-1400-B7F. Worthington Pump and Machinery Corporation, Multi-V-Drive Sales Division, Buffalo, N. Y.

**1.** Light hub goes on first . . .

**2.** Then heavier rim slides on

**3.** Or mount both hub and rim together

**Worthington QD**

Trade Mark Pat. No. 2369821

**ORIGINAL TAPERED CONE-GRIP SHEAVE**

***Most Widely Used Hub and Rim Combination***

Split hub is clamped to shaft. Heavier taper-bored rim slides easily over tapered hub—no keyway obstruction on cone surface. Positive press fit on shaft. Large, long pull-up bolts also used as jack screws to remove rim.

**WORTHINGTON**

**THE GOOD RIGHT HAND OF INDUSTRY**

**POWER TRANSMISSION:** sheaves, V-belts, variable speed drives

**PUMPS:** centrifugal, power, rotary, steam

**AIR COMPRESSORS:** water-cooled, air-cooled

# How to speed up speed changes

***an idea "Kicked in" by a WORTHINGTON DISTRIBUTOR***

Pye-Barker Supply Co. of Atlanta comes through with *this* idea.

Many of its textile mill customers receive orders for yarns of different sizes. In processing these different sizes, speed changes—particularly on spinning frames—must be made often and quickly.

Pye-Barker, Worthington distributor, had the answer—Worthington QD sheave—the sheave that lets you change rims for speed variation without disturbing alignment. Why? Because the hub stays in place and the new sheave bolts easily and quickly in proper alignment.

To make the operation even faster, the textile mills painted the various rims a different color, one for each speed variation required—assuring the right rim, the right speed, and proper alignment.

MV.1.8A

# TORTURE CHAMBER

## for VALVE and FITTING MATERIALS

Here, steam up to 1500 pounds pressure and 1000° F. gives Vogt the answer to any question of materials or construction for valves and fittings in just a few days . . . facts that would take years to obtain under normal operating conditions!

We set up our own Torture Chamber to determine the durability of valve packings and gaskets; the resistance of various steels to corrosion and erosion; and how hard and how smooth surfaces of seats, discs and stems must be to withstand steam at high pressures and high temperatures. We tested and found an ideal yoke nut material, and we uncovered facts on joint design that could be found in no other way.

Thus, by constant and accelerated testing, we quickly and definitely prove or disprove the claims that are made for many newly developed materials. And thereby we make sure that only the best goes into valves and fittings that bear the name Vogt.

*Consult Catalog F-9 for the complete Vogt line of drop forged steel valves, fittings and flanges for steam, water, oil, gas, air and refrigeration services.*

**HENRY VOGT MACHINE CO., Louisville 10, Ky.**

BRANCH OFFICES: NEW YORK • CHICAGO • CLEVELAND
PHILADELPHIA • ST. LOUIS • DALLAS • CHARLESTON, W. VA.

# ♫ ZEIGLER ... It's a grand old name ♫

Ever since 1904, coal buyers have been singing the praises of ZEIGLER COAL. During the past 48 years millions of tons have been mined and shipped by rail and water to dealers and industrial plants throughout the middle west—indisputable testimony to its excellence. Through the years, this high grade coal has been mined, cleaned and processed by the newest methods. As fast as new devices and improvements in preparation methods were developed, they were adopted in the ZEIGLER plant. This policy has never varied, and today, after continuous progress, ZEIGLER still means the last word in coal production.

Among the famous *select* coals produced and distributed by Bell & Zoller Coal Company, ZEIGLER is truly a grand old name. Today, as for years past, GENUINE ZEIGLER SUPER-X, and SUPERWASHED ZEIGLER are prime favorites with selective users of coal.

COAL HEATING SERVICE

## BELL & ZOLLER COAL COMPANY

BELL BUILDING, CHICAGO 1, ILLINOIS

*ST. LOUIS • NASHVILLE • OMAHA • MINNEAPOLIS*

*Sixty-Six Years of Service to Coal Users*

**Producers of**
**ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, and BUCKHORN Coals**

*Sales Agents for*
Mulberry Hill Coal Company
Freeburg, Illinois

Otter-Eagle Coal Company
Lockwood, West Virginia

Boone County Coal Corporation
Sharples, West Virginia

*in*

**FEEDING**
**CONVEYING**
**ELEVATING**
**REDUCING**
**DRYING**
**COOLING**
**PACKING**
**SCREENING**

Vertical and inclined Bucket Elevators with spaced or continuous buckets mounted on chain or belt. A complete line of standards.

Belt Conveyors for handling a wide variety of loose, bulk material. Roller or ball bearing troughing (or flat) and return idlers for belt widths from 14" to 60". Large capacities and a steady flow.

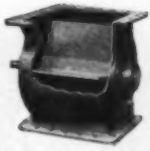
Spiral Conveyors will handle many kinds of material with clean, dustless operation. No return strand. Standard types — also many special designs and applications. Interchangeable with other makes — built to industrial standards.

A complete line of Crushers, Pulverizers and Shredders for reducing most any kind of material to desired fineness.

Electric Vibrating Feeders provide absolute control over feeding operations. Open or closed pan, or tubular decks. Capacities from a few ounces up to many tons per hour.

Car Pullers for spotting from one to six cars. Two sizes.

Rotary Bin Check Valves —insure a constant, uninterrupted flow of fine flooding material to vibrating Feeders or WAYTROLS. Also Bin Level Indicators.



Rotary-type Feeder for feeding finely pulverized material. Also Spiral, Apron, Belt, Plate and electric-vibrating type Feeders.

Low Head Barrel Packer for economy in packing operations. Reduces size of containers, increases capacity and cuts shipping costs. Also supplied with deck to provide conveying action during packing operations.

# JEFFREY

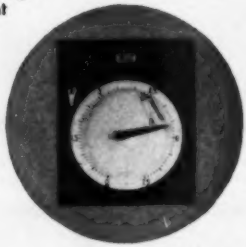
ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

Measures fundamental indicator of combustion efficiency—Oxygen. Applicable to power plants and process problems like catalytic crackers, open hearths, process heaters, inert gases, etc.

**PRINCIPLE** — Based on paramagnetic (attracted by magnetism) properties of Oxygen.

**FEATURES** — Highly sensitive to change in $O_2$ content — responds rapidly. Electrically operated. Electronic type recorder. Temperature controlled. Pressure compensated. No liquid or gaseous fuel required. No chemicals. Highly accurate. Not affected by wide change of gas flow rate. Continuous sampling and recording. Glass and corrosive resistant sampling system. Remote mounted analyzer and recorder. Four records on same chart possible. Low maintenance.

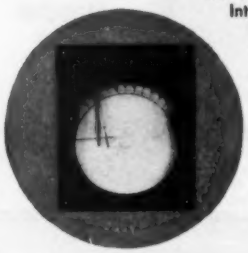


## Hays Magnotherm $O_2$ Meter

Provides a *QUANTITATIVE* guide to efficiency — deals with quantities of air and steam; by contrast $CO_2$ and $O_2$ meters are *QUALITATIVE* guides since they determine directly quality of combustion gases.

**PRINCIPLE** — Record of steam flow is assumed to be Btu's produced; record of air flow is calibrated to flow of air required to generate that steam.

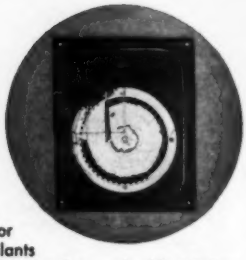
**FEATURES** — Electric operation of flow meter and air flow recorder. Diaphragm-type air flow measuring unit. Air flow measuring element does no work. Air flow recorder—motor operated. Adjustable cam air flow calibration. Mercury transmitter — pressures to 2500 psi. Interchangeable range tubes for steam flow. Remote mounted steam flow transmitter. No high pressure piping into panel. Easily installed and adjusted. Low maintenance.



## Hays-Penn Boiler Efficiency Meter

# Which combustion guide is best?

IT DEPENDS . . . on the fuel you're burning, the accuracy you require, the price you want to pay, etc. Your particular needs will determine your choice . . . but remember—only Hays can supply you *without bias* . . . because only Hays has a *complete* line of Combustion Guides.

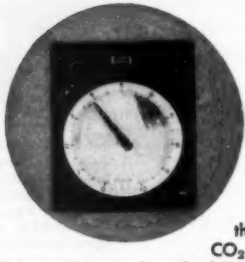


## Hays Combustion Meter

Hundreds of these meters have been in operation for many years in all types of plants burning all kinds of fuels and saving thousands of fuel dollars.

**PRINCIPLE** — Operates on Orsat principle of volumetric measurement and chemical absorption. Difference in sample before and after absorption gives exact percentage of $CO_2$ absorbed by chemical.

**FEATURES** — Low price. Water operation. Pressure and temperature compensated. Volumetric determination. Chemical absorption. 2-minute operating cycle. Easily understood. Rugged construction. Low maintenance. Available in 6 remote mounted types and 3 integral types: (a) $CO_2$ only—recording with or without indicator (b) $CO_2$ and flue gas temp. recorder combined (c) $CO_2$, draft or flue gas temp. recorder combined. Remote or integral mounting.



## Hays Condu-Therm $CO_2$ Meter

A new instrument using three *established* ideas: (1) $CO_2$ as guide to combustion efficiency (2) thermal conductivity principle (3) electronic type operation.

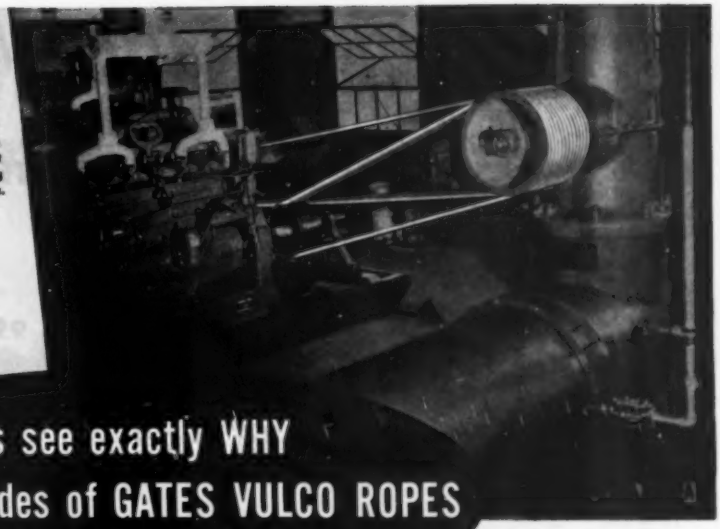
**PRINCIPLE** — Based on thermal conductivity of gases, i.e., that all gases conduct heat at different rates.

**FEATURES** — 5-second response to change in $CO_2$ content. ± .25% accuracy for ranges 0 to 20%. Electrically operated. Electronic type recorder. Temperature controlled. Humidity controlled. No chemicals required. No moving parts in analyzer. Continuous sampling. No drying agent required. Unmatched construction features. Not affected by wide change in gas flow rate. High sensitivity. Rapid response. Continuous recording. Remote mounted analyzer and recorder. Low maintenance.

## THE HAYS CORPORATION

*MICHIGAN CITY 2, INDIANA*

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Venturi Meters and Venturi • Gas Analyzers • Draft Gages
Combustion Test Sets • $CO_2$ Recorders • Electronic Oxygen Recorders



To drive one of the new high capacity pumps which removes surface water and runoff from 15,000 acres of Illinois farmland, members of the District Board chose Gates Vulco Ropes, running from two diesel units.

# Let's see exactly WHY the Concave Sides of GATES VULCO ROPES mean lower V-Belt Costs!

Every engineer knows how a V-belt *changes shape* when it bends around a pulley.

The top of the belt is under tension—making it grow *narrower.*

The body is under *compression,* causing the sides to bulge out!

Look at figure 1-A in the diagrams, herewith. There you see how a *straight sided* V-belt is forced to bulge in its sheave-groove—and this bulging naturally causes extra wear along the middle of the sides as indicated by the arrows.

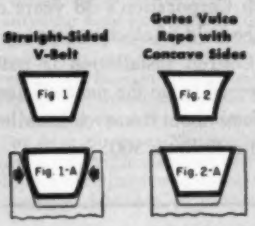
Now look at the figure 2-A. There you see how the precisely engineered Concave Sides fill out to an exact fit in the sheave groove.

Clearly, the Concave Sides press *evenly* against the V-pulley. This means uniform wear; longer life! The Concave Sides have *full traction;* wear longer because of *full contact!*

**To sum up: The Concave Sides of Gates Vulco Ropes (U.S. Patent No. 1813698) give you (1) Less wear, (2) More pulley contact, (3) More sure power transmitted when needed!**

Only V-belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure you get the V-Belt with the Concave Sides—The Gates Vulco Rope!

**What Happens When a V-Belt Bends**




How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-521

*World's Largest Maker of V-Belts*

Gates

Hose V-Belts Molded Rubber Goods for Industry

VULCO ROPE DRIVES

ENGINEERING OFFICES AND JOBBER STOCKS IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY • DENVER • U•S•A

# *"For high dust collection efficiency* CONSIDER THESE FACTS!"

**95% to 99% REMOVAL**

*Your* specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

**LOW DRAFT LOSS**

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

**DURABILITY**

Low velocities hold abrasion to a minimum.

**ANY CAPACITY**

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

**OTHER APPLICATIONS**

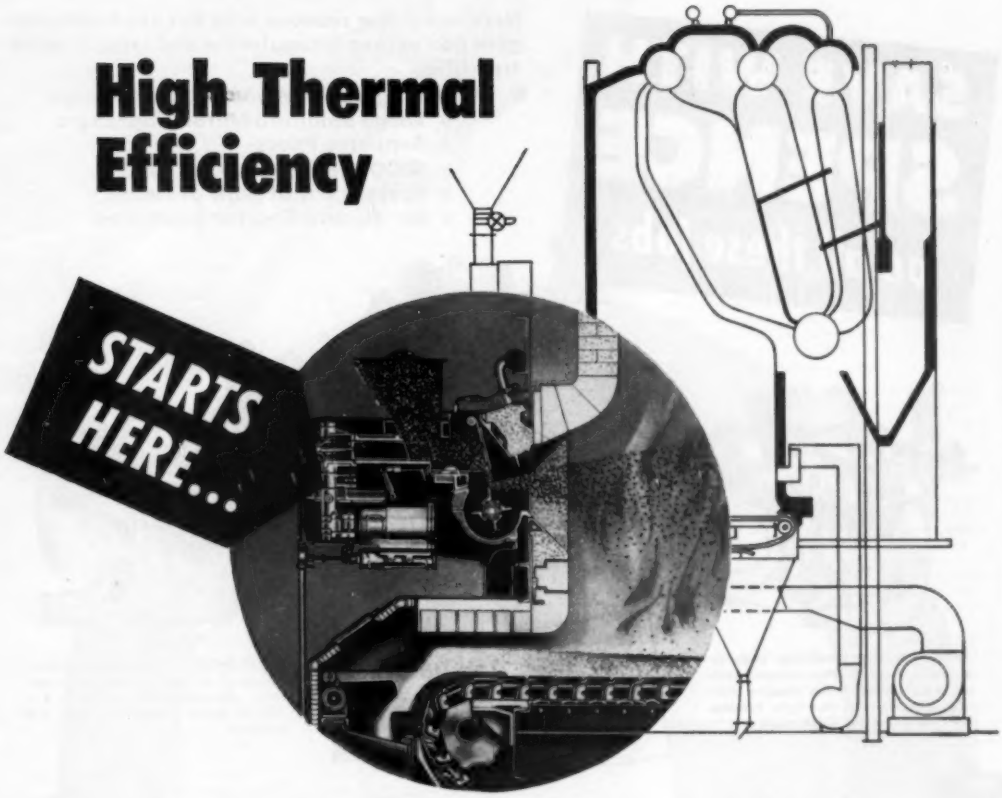
Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

**RESEARCH CORPORATION**

*405 Lexington Avenue, New York 17, N. Y.*
*122 South Michigan Avenue, Chicago 3, Illinois*

# High Thermal Efficiency




## It pays to choose your stoker carefully!

The coal-burning efficiency of your stoker is the starting point of coal saving . . . because the coal is all burned by the stoker and the coal bill is your major operating expense.

The burning of fuel for steam generation has always been one of the most exacting jobs that a machine can be called upon to perform. A stoker must operate twenty-four hours a day, seven days a week, for periods of six months or a year without a shutdown. The interior parts are exposed to heat and corrosion, the exterior mechanism to dirt and dust. A forced shutdown of the stoker may mean curtailment of production and cost the user many times the price of the stoker.

For over 60 years Westinghouse has maintained a consistently high standard of performance, while developing ever improved stokers to keep pace with the increasing demands of industry. And to make this assurance doubly sure, Westinghouse maintains a staff of experienced combustion engineers in all principal cities to make periodic inspections and give prompt attention to any operating problems.

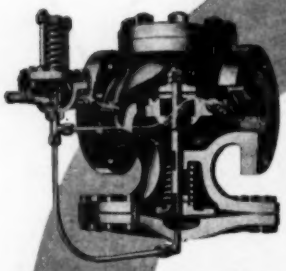
Before you invest, be satisfied you are buying the best stoker. Westinghouse offers a complete line of underfeed and spreader stokers for use with any boiler of your choice. Capacities range from moderate to over 400,000 lbs. of steam per hour. Get the full story. Call your nearby Westinghouse office . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30525

YOU CAN BE SURE...IF IT'S
Westinghouse
STOKERS

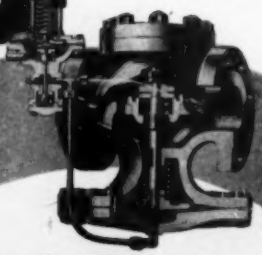
# SAVE WITH SPENCE on all these jobs

***Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:***

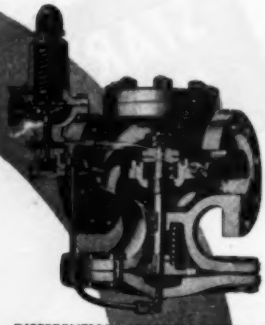
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



**BACK PRESSURE CONTROL**—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

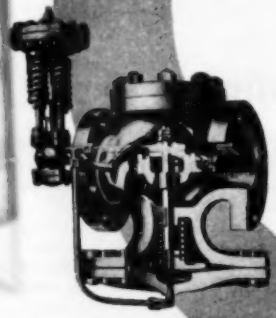


**PRESSURE REDUCING**—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

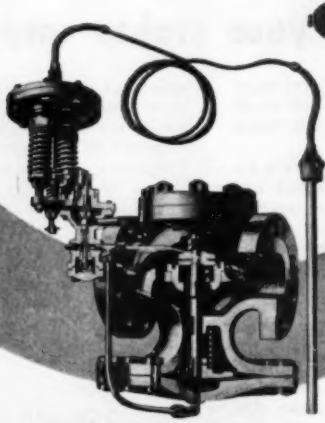


**DIFFERENTIAL PRESSURE**—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

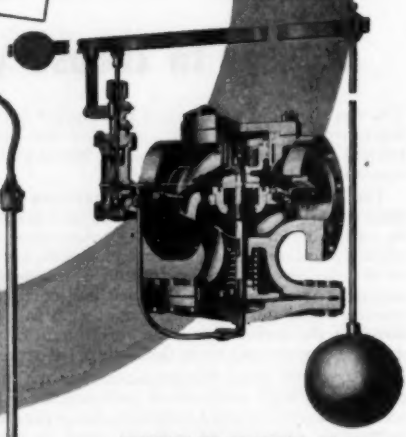
**WRITE FOR BULLETIN 350**
*for complete details on Spence's line of automatic regulating valves*



**PUMP GOVERNOR**—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



**TEMPERATURE REGULATING**—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

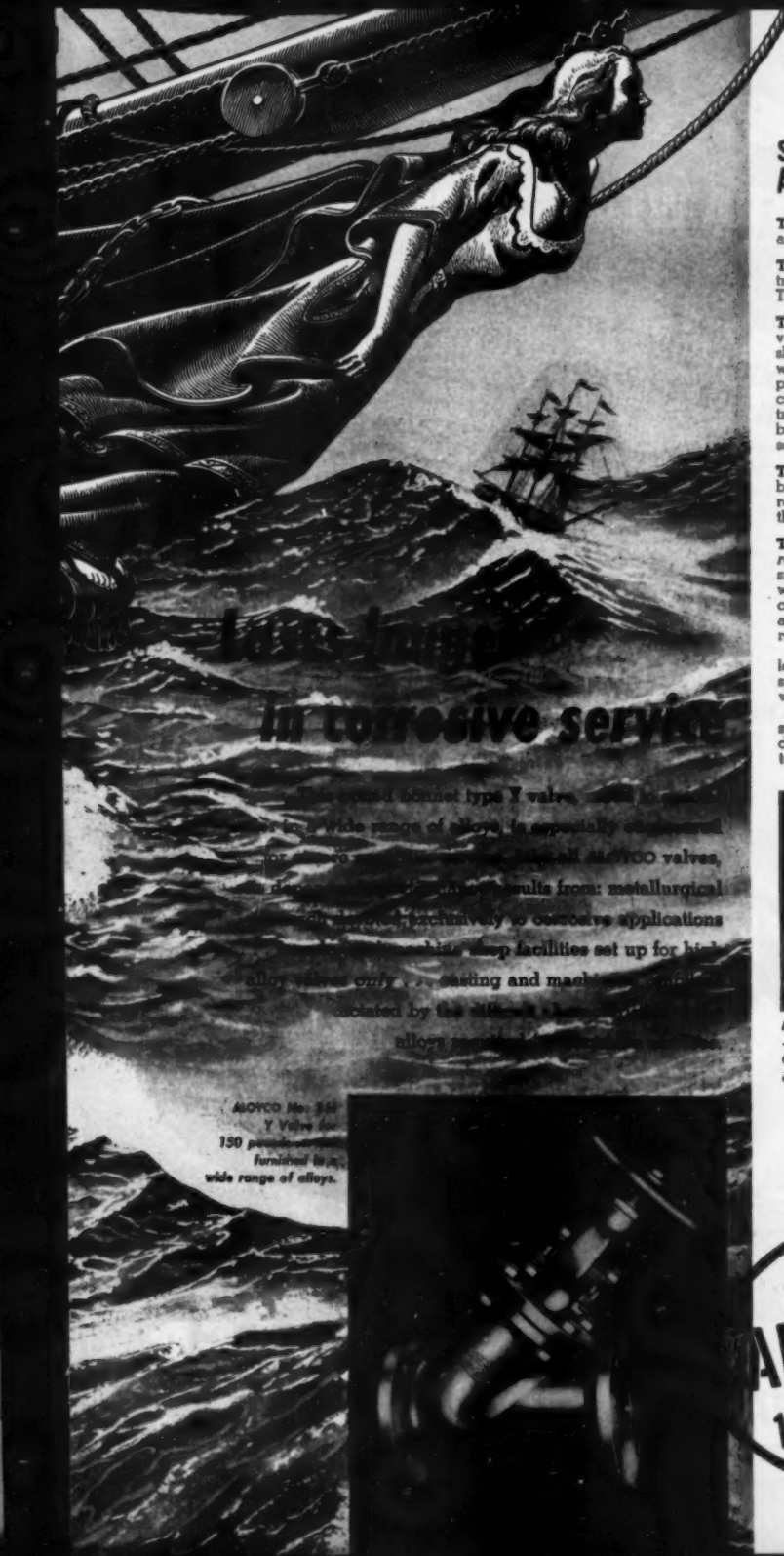


**LEVER OPERATED**—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

66-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence



## SUCCESS STORIES FROM ALOYCO'S CORROSION CLINIC

**THE CORROSIVE:** 50% caustic soda and other industrial chemicals.

**THE PLACE:** S. S. "Marine Chemist", transporting bulk chemicals from Freeport, Texas, to northeastern ports of United States.

**THE VALVE:** ALOYCO 20 No. 111 gate valves. Valves in the ballast tanks of the ship are alternately submerged in sea water while caustic soda and other chemicals pass through the valves. In some instances, chemicals are in constant motion during transportation. Temperatures of 100°F and better must be maintained to keep caustic soda from solidifying.

**THE RESULTS:** ALOYCO valves have been successfully combating *interior* corrosion and *external* corrosion as well in this unusual application for two years.

**THE BACKGROUND:** The *Aloyco Corrosion Clinic* works exclusively in corrosion-resistant alloys. If your problem—whether it be corrosion, contamination, discoloration, temperature extremes, or proper application—can be solved by corrosion-resistant valves, it is one for the Clinic.

ALOYCO concentrates on providing longer valve life in corrosive service. Result: More ALOYCO corrosion-resistant valves are used than any other brand.

ALOYCO is the *largest* manufacturer specializing in high alloy valves. For a dependable solution, put your problem up to *Aloyco's Corrosion Clinic*.

*Marine Transport Lines' floating chemical carrier —S. S. "Marine Chemist"—in service for the Dow Chemical Company—transports bulk industrial chemicals.*

**ALLOY STEEL PRODUCTS CO., INC.**
1305 West Elizabeth Avenue, Linden, N. J.

**Longer Lasting**

# ALOYCO VALVES

**1st in Corrosive Service**

# Toughened

## FOR EXTRA WEAR...POSITIVE POWER

### EXCLUSIVE ATLAS TOUGHENING PROCESS GIVES EXTRA STRENGTH FOR RUGGED SERVICE

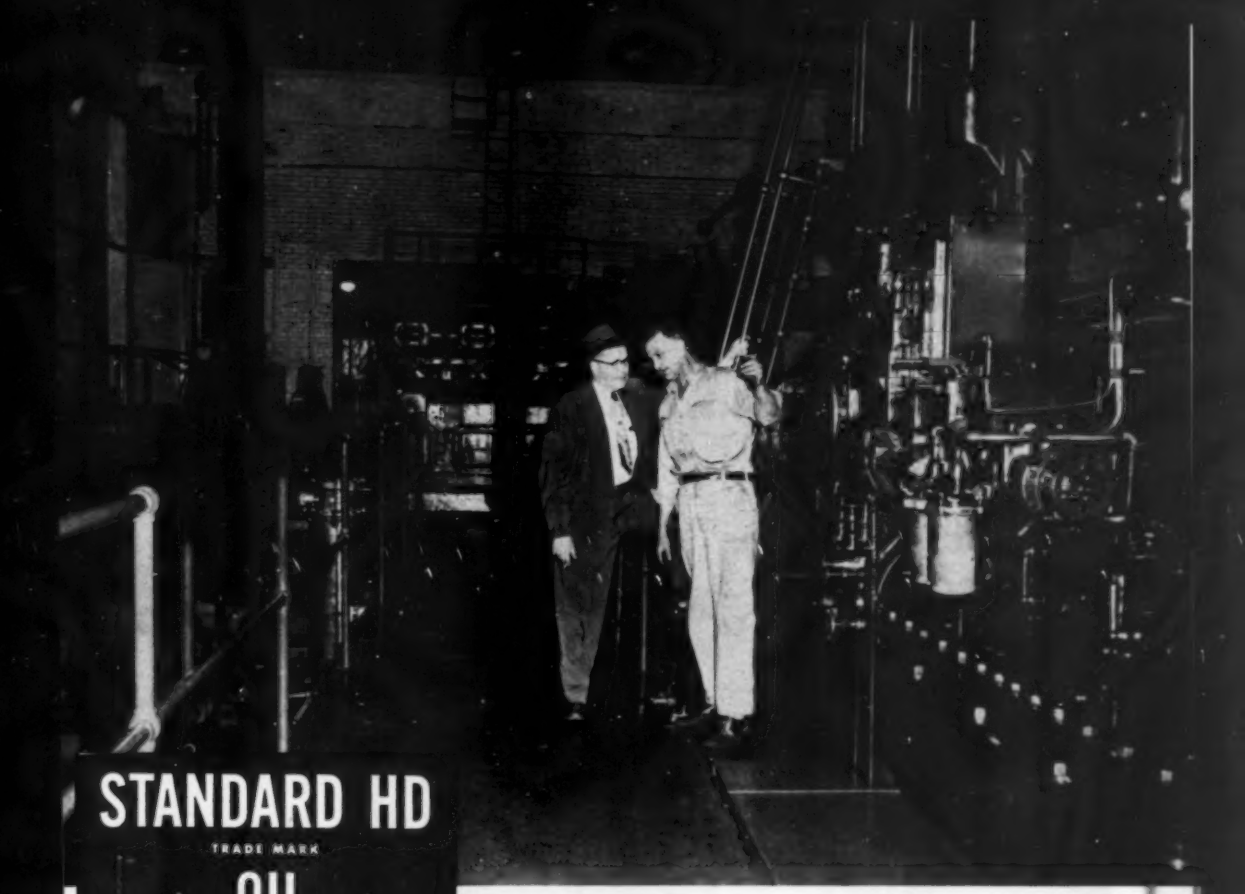
On power transmission drives throughout industry, Atlas "Super Life" Roller Chain is giving extra wear . . . delivering efficient, positive power. Atlas Chain is heat-treated by an exclusive hardening process, which builds in greater strength and wear resistance than conventional hardening. Built to take a beating, Atlas gives long life, maximum service under severest operating conditions.

On all types of machine drives, Atlas Chain transmits power smoothly and efficiently. Positive "no slip" sprocket grip makes possible delivery of full rated horsepower without slippage or friction.

For extra wear . . . positive power . . . long trouble-free service, install Atlas on your drives. Write today for new roller chain fact book No. ARC-52IP.

**ATLAS CHAIN & MANUFACTURING COMPANY**
**PHILADELPHIA 24, PENNA.**

# ATLAS ROLLER CHAIN



STANDARD HD
TRADE MARK
OIL

# Solves a diesel maintenance problem

● Excess cylinder and ring wear plus sludge, varnish, and carbon deposits posed a costly maintenance problem for operators of this municipal power station. Overhauls were scheduled every six months. A full set of rings was installed at every overhaul. That was the situation in 1947 when a Standard Oil lubrication specialist recommended changing to STANDARD HD Oil.

The change was made on one of the station's five diesels. These are the results with STANDARD HD.

Time between overhauls has been doubled, and normally only the two top rings are changed. Cylinder wear has been cut to a minimum, even with the engine operating under heavier loads. The engine has remained clean and there has been no ring sticking. Efficiency has been stepped up from an average of 12.0 KW per gallon of fuel to 12.5 KW per gallon.

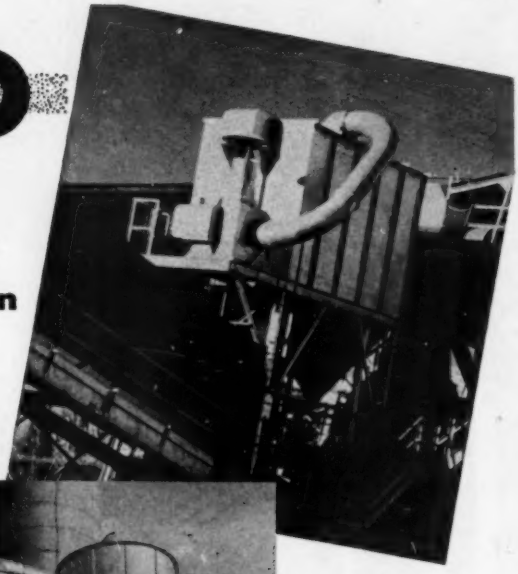
These results, the solution of a costly maintenance problem, have led to the use of STANDARD HD Oil in the station's four other diesels. Chances are that a Standard Oil lubrication specialist can help you achieve similar results in the operation and maintenance of your own diesel equipment. Put him to work on your problem today. A call to your local Standard Oil Company office is all that's necessary. Or write: Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

**STANDARD OIL COMPANY** STANDARD *(Indiana)*

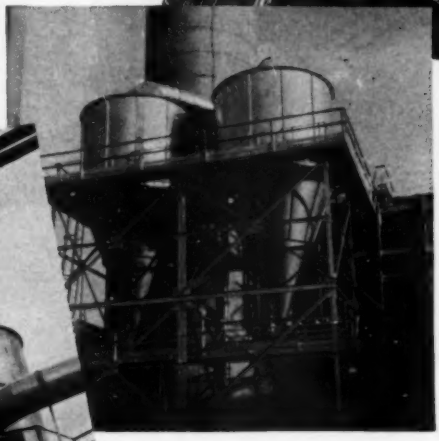
# Norblo

**helps you to achieve outstanding efficiency in dust and fume collection**

***with these three important systems***



**Automatic Bag Type**



**Cyclone**

**Hydraulic**

Norblo *Portable* Dust Collecting Units, bag or filter types, give you localized dust control. Comply with all state and city codes. Three sizes, six rating selections from 300 C.F.M. to 1350 C.F.M. Write for Bulletin 163-5.

Dust and fume control ranks high among the facilities considered necessary in modern industrial operations. Now you figure the economy of safeguarding against explosions — of increasing the general efficiency of your plant — of salvaging valuable fumes and dusts.

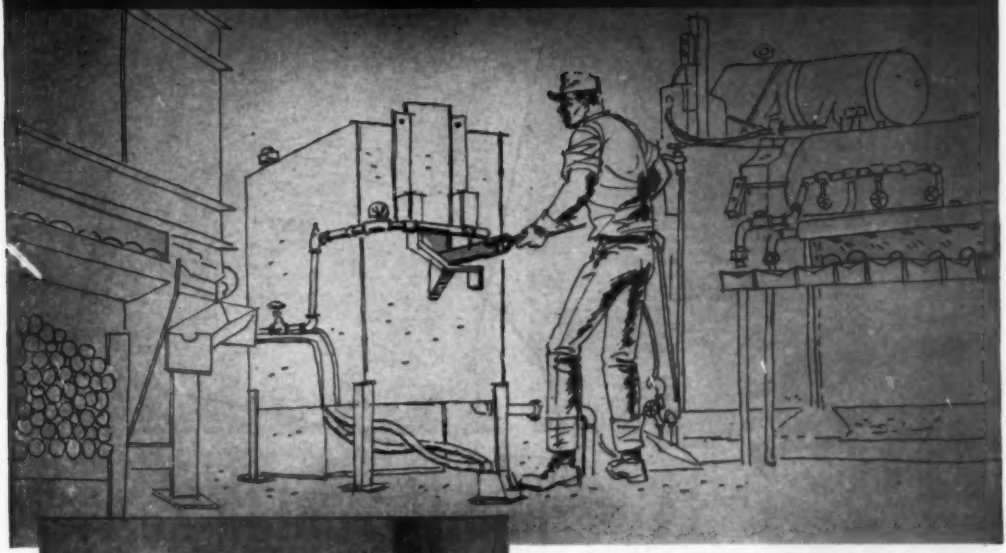
Norblo makes three principal types of collection systems — engineers each installation from first hand experience of 40 years in many industries. High-efficiency equipment having the correct factors to suit your needs includes the Norblo guarantee of performance, economy and low maintenance. Before you decide on any fume or dust collection equipment consult the Norblo engineering department.

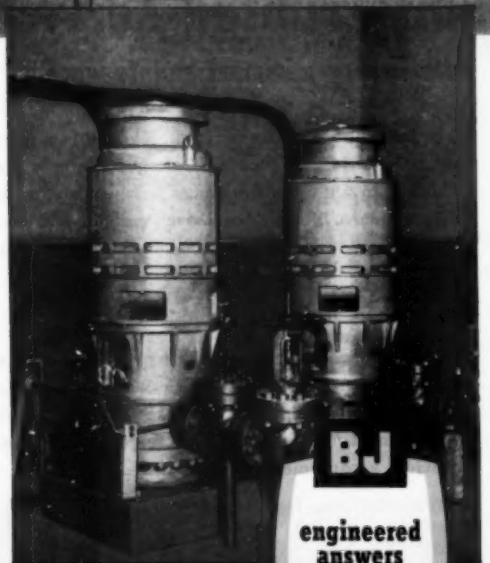
## THE NORTHERN BLOWER COMPANY

***Engineered Dust Collection Systems for All Industries***

**6422 BARBERTON AVE. • CLEVELAND 2, OHIO**

# KNOCKS OFF SCALE IN 1½ SECONDS!






This automobile plant uses two BJ Hydropress Pumps for descaling. One pump services as many as 10 cabinets (with 5 operating at once).

## *Auto industry uses BJ Hydropress Pumps to descale forged parts hydraulically!*

Manual or mechanical descaling operations are time-taking and profit-robbing. Especially when a product requires several descalings during production. You'll save time, money and rejects by descaling hydraulically with BJ Hydropress pumps.

Here's one of the many examples of modern hydraulic descaling as used by the automotive industry. During the heating of axle bars prior to forming, scale is created and must be removed. This is done in a hydraulic descaling cabinet. As the bar is inserted, a lever is tripped and high velocity water at 1500 to 2000 psi hits the bar from 3 to 5 nozzles. Scale is removed in 1½ seconds! Afterwards the hot bar is placed on a forming roll.

The BJ Hydropress pump is ideal for this type of work because of its unique construction features. It does not require relief valves, accumulators or extra heavy fittings and piping. Its double volute design creates inherent balance at all heads and capacities. Its vertical construction allows the use of a simple foundation and a minimum of floor space.

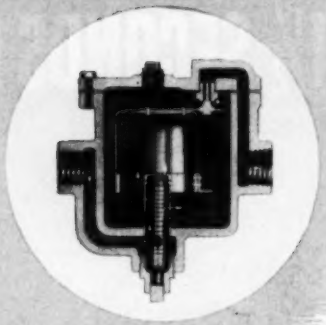
**For more information call your local BJ sales engineering office or write:**

**Byron Jackson Co.**

Since 1872

**P. O. Box 2017, Terminal Annex, Los Angeles 54, California**

**Sales Offices in Principal Cities**



Here is one of the four different traps made by Sarco—the Inverted Bucket Steam Trap with straight-thru connections for easy inspection. Mechanism is attached to the cover; accessible without disturbing pipe connections. Since 1936 all sizes have been factory-equipped with integral strainers at no extra cost. REAL capacities are exceptionally large.

KIMBALL LAUNDRY CO.

June 7, 1951

Sarco Company, Inc.
Empire State Building
New York, New York

Gentlemen:

Before standardizing on Sarco traps, we used many different makes in an attempt to find one that would be suitable from a service and maintenance standpoint.

At the present time our plant is equipped approximately ninety per cent with Sarco traps. This conversion has taken place over the past three years.

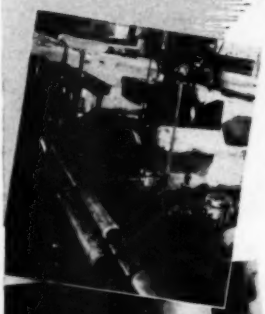
Sarco traps gave us the thing we had been looking for -- uninterrupted service with a very minimum maintenance.

Yours very truly,

KIMBALL LAUNDRY COMPANY

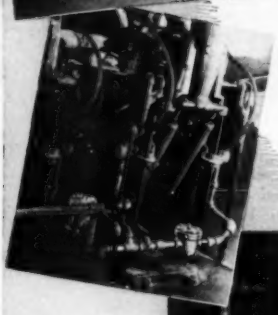
By A. [illegible] Gunthuyer
Secretary

ALG:mb



On steam irons for silks, the Sarco steam traps assure absolutely dry steam.

Sarco Steam Traps removing condensate from main steam header at boiler.



Sarco Steam Traps draining collar and cuff ironers.

Sarco Steam Traps keeping drying tumblers free of air and condensate.

# "uninterrupted service

## *with a very minimum maintenance"*

The letter above speaks for itself. Kimball Laundry is one of the largest west of Chicago. While it was founded in 1886, its equipment today is among the most modern. You too can have "uninterrupted service with a very minimum maintenance," by using

## SARCO STEAM TRAPS

Just install one in the toughest spot in your plant and let it prove itself—it will! Sarco makes four distinct *types* of traps and can fit the trap to the job. Our manual "Steam Hook-ups" explains how and provides a convenient selection chart.

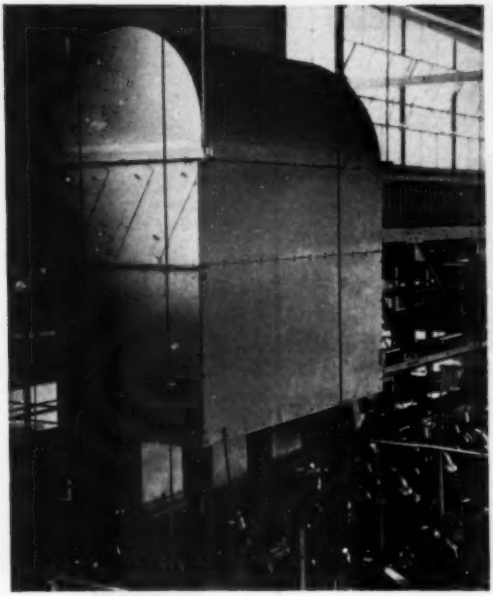
Write for your free copy today. 358

**SARCO COMPANY, INC.**

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

SARCO CANADA LTD., TORONTO 8, ONTARIO

REPRESENTED IN PRINCIPAL CITIES



**Factory Area . . . Cold Room . . . Cafeteria . . . Press Room . . . Lockers**

# Trane Air Conditioning Serves Everywhere in Industry

Whatever your problem may be in industrial heating and air conditioning, it can be effectively solved with products from the complete Trane line.

**In Factory Areas**—A lot of heat must be thrown a long way in plants such as the one belonging to an eastern fastener manufacturer. Big Trane Torridors, the high-output blower unit heaters, handle these jobs most effectively. They may be hung from the ceiling, mounted on the wall, or set on the floor to fit a particular installation.

**In Cold Rooms**—A research center maintained by a large manufacturer's association makes tests under many different climatic conditions. Trane Climate Changers with humidifiers are used to supply air at just the right moisture content and temperature for each desired testing condition.

**In Cafeterias**—To heat the large open area of its modern new cafeteria, an eastern dye manufacturer required attractive cabinet type heating units with the capacity of unit heaters. Efficient hidden heating was supplied by Trane Force-Flo Heaters recessed in the knotty pine wainscoting.

**In Press Rooms**—Newspaper presses operating at high speed fill the press room with an ink mist. A metropolitan newspaper used Trane Centrifugal Fans for the rapid and efficient change of air.

**In Locker Rooms**—Employee locker rooms in this modern factory presented a heating problem because the high lockers hindered the even distribution of heat. Year-round comfort is maintained by Trane Projection Unit Heaters with Louver Cone Diffusers. The warm air is spread out along the ceiling, and gently forced down between the lockers.

Whether it's factory areas, cold rooms, cafeterias, press rooms or locker rooms, Trane heating and air conditioning serves everywhere in industry.

***Whatever your heating, cooling, ventilating, or air conditioning problem is, look for the answer in the complete Trane line.***

**In Cafeterias**—Trane Force-Flo Heaters provide a quiet-operating cabinet type heating unit which combines the attractive appearance of the convector and the extra capacity of the unit heater.

**In Press Rooms**—Trane Centrifugal Fans are compact, quiet, economical and efficient air handling units that are ideal for heating, ventilating, air conditioning and a great number of industrial applications.

**In Locker Rooms**—Trane Projection Heaters with Louver Cone Diffusers allow completely flexible control of all the air. Many diffusion patterns, from horizontal blanket to vertical shaft, may be obtained.

**TRANE**

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa. Trane Company of Canada Ltd. . . . Toronto

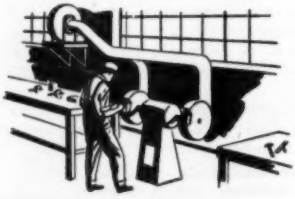
OFFICES IN 80 U.S. AND 14 CANADIAN CITIES

## American Blower... a time-honored name in air handling

**Charleston, W. Va.,** has a conveniently located American Blower Branch Office to provide you with data and equipment for air handling. You can reach American Blower in Charleston by calling 61-331. In other cities consult your phone book.

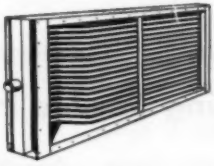
### EMPLOYEE COMFORT

Fresh, invigorating air, indoors, does much to increase employee morale and efficiency. American Blower Ventura Fans are ideal for the job. They're attractively streamlined propeller fans with smooth-flowing lines that harmonize well with modern business interiors. Wiring is fully enclosed for safety. A square mounting panel makes them easy to install. All Ventura Fans are sound-rated and capacities are Certified.



### ABRASIVE MATERIALS

If you've found dust from grinding machine operations hard to handle, American Blower Type V Fans are well worth investigating. The heavy cast-iron housing of Type V fans easily withstands the wear of hard, gritty, abrasive materials. Also, their volume and pressure range is more than adequate to handle the normal requirements of this type of work. Remember, good ventilation is good business.

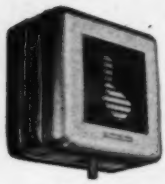


### HEATING COILS

Current demands for heating from business and industry are greater now than ever before – a good reason to take early action on American Blower Heating Coils. Whether you need coils for use in blast heating or zone reheating – you'll find the size and type to fit your needs in the American Blower line. All tubing is helically wound with copper or aluminum fins in 3 standard spacings. Casings are heavy galvanized steel; headers are die-formed steel.

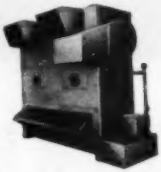
### YOUR BUSINESS

Whatever your needs, American Blower heating, cooling, drying, air conditioning and air handling equipment will improve over-all comfort and efficiency in your business. For data, phone or write our nearest branch office.

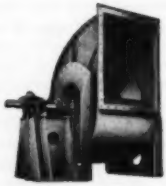


Unit Heaters

Ventura Fans



Air Conditioning Equipment



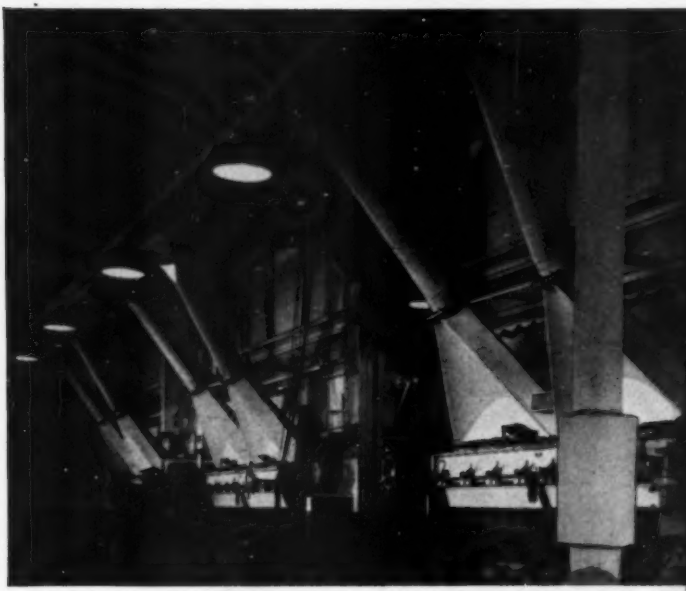
Industrial Fans

Utility Sets

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

*Serving home and industry:* AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • BOSS HEATER • TOLHAVANA IRON



# do your boilers need?

? ADJUSTMENT OF PRE-TREATMENT

? ADJUSTMENT OF INTERNAL TREATMENT

? PROPER MEANS FOR TREATMENT APPLICATION

? BLOWDOWN ADJUSTMENT

? TEST CONTROL

then CALL YOUR DEARBORN ENGINEER OR WRITE FOR THIS VALUABLE BOOKLET.

Bulletin 5000 describing Dearborn's Industrial Water Treatment and Engineering Service will be sent on request

## 65 years of water treatment experience available to you

Since 1887, Dearborn has strived to make the problem of providing trouble-free water for users of steam as simple and economical as possible.

Today, Dearborn has every facility—plus a broad background of experience—to help every business, every plant reduce the cost of maintaining its boiler room or power plant operation.

Dearborn Sales Engineers—thoroughly trained to analyze your plant and evaluate your needs—are available to you for consultation, without obligation.

**DEARBORN CHEMICAL COMPANY**

Merchandise Mart Plaza • Chicago 54, Illinois

Dearborn Chemical Company, Dept. INP
Merchandise Mart Plaza, Chicago 54, Ill.

☐ Please send Bulletins 5000
☐ Have a Dearborn Sales Engineer call

*Name*.....

*Position*.....

*Company*.....

*Address*.....

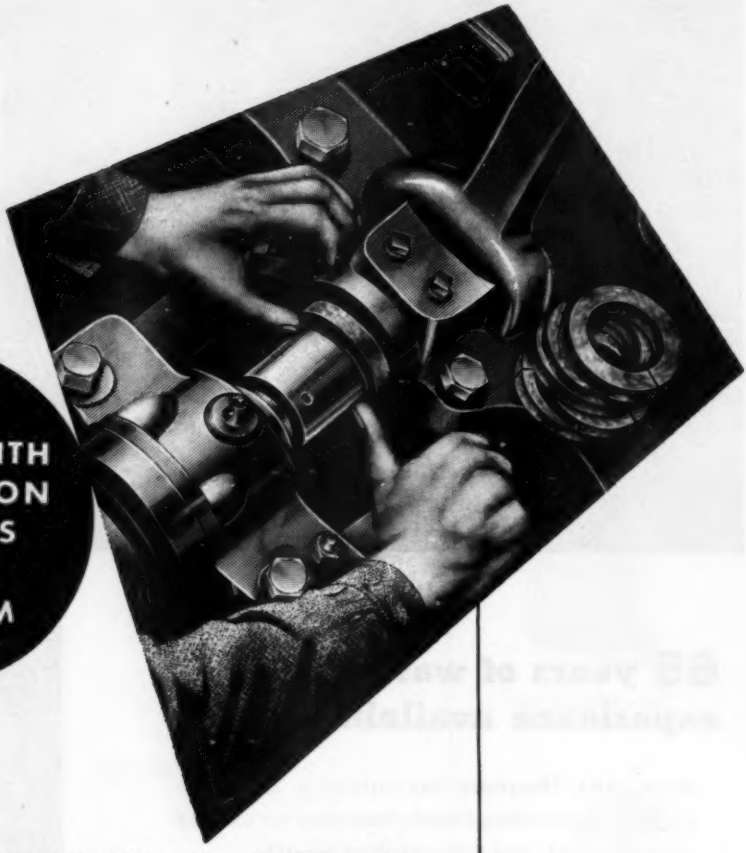
*City*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH R/M



In the widely diversified line of Raybestos-Manhattan packings and gaskets, you will find products specially made to solve your toughest packing problems. Let your nearby R/M distributor help you specify the packings that will assure you of long trouble-free operation. Give him a call today.

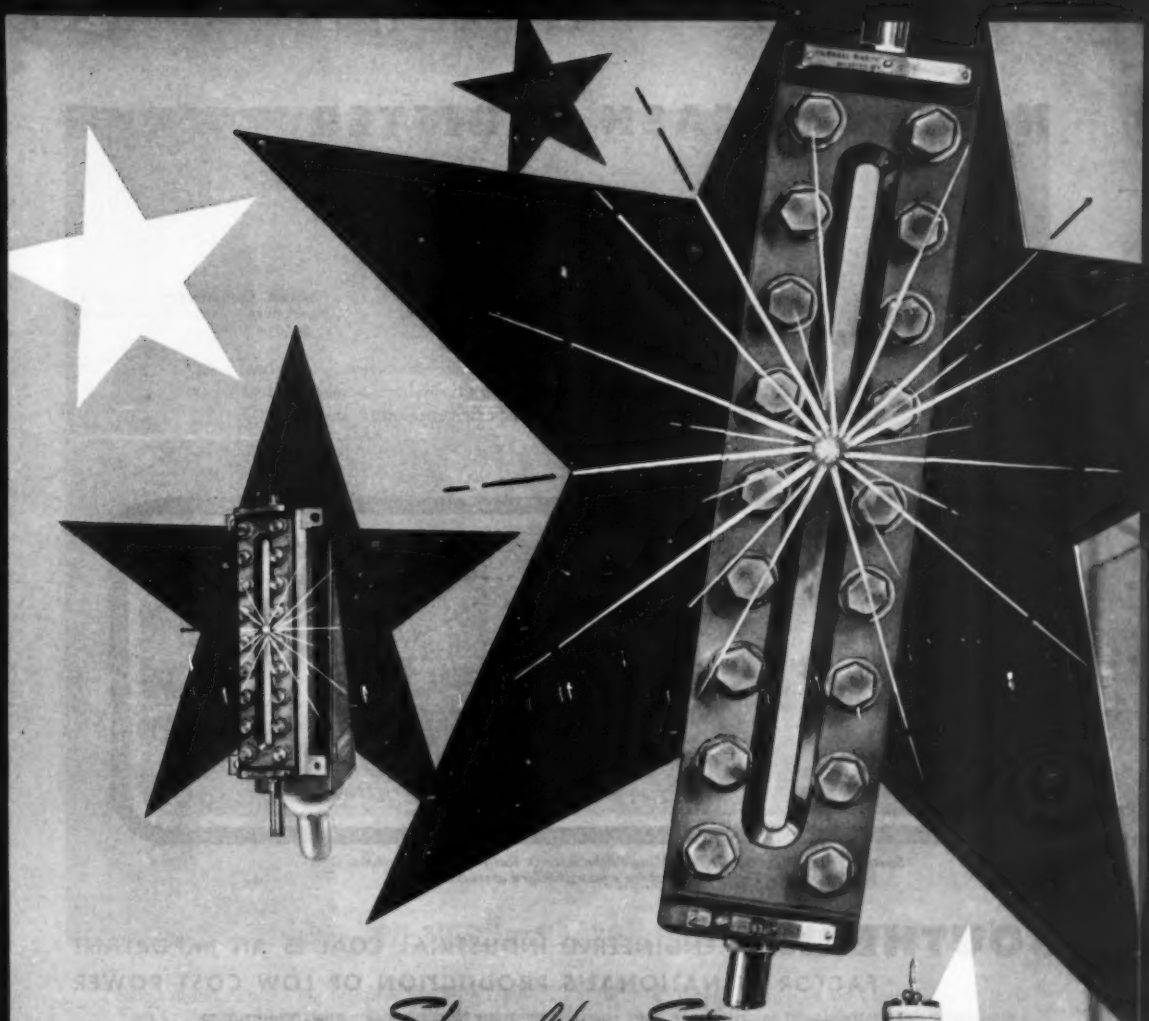
R M PACKINGS

**RAYBESTOS-MANHATTAN, INC.**

**PACKING DIVISION, MANHEIM, PA.**

**FACTORIES:** Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls



**BOILER WATER LEVEL** *Shines like a Star*

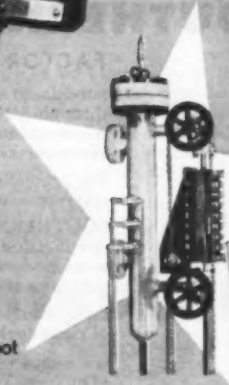
**WITH YARWAY TYPE "M" ILLUMINATOR**

Now you can *really* see that boiler water level.

Extraneous light, dust particles in the air, deposits on the gage glass—none of these stop the superior penetration of the blue-white light from the Yarway Type "M" Illuminator. It makes the meniscus at water level *stand out like a brilliant star.*

The Type "M" Illuminator is designed to give maximum brilliance, and spot the water level over its entire traverse. It's effective over longer distances.

Equip new or installed Yarway Flat Glass Gages with the Type "M" Illuminator for a new high in easy gage reading. For specifications and prices call your nearest Yarway office or write . . .

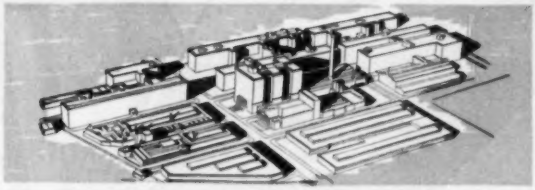


Yarway Floatless Hi-Lo Alarm Water Column with Vertical Pressure-Sealed Flat Glass Gage. Equipped with Type "M" Illuminator. For pressures to 2900 psi. See Bulletin WG-1811.

**YARNALL-WARING COMPANY**
109 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

**STEAM PLANT EQUIPMENT** • • • **YARWAY**

# NATIONAL CASH REGISTER



*National Cash Register Company's great headquarters plant located in Dayton, Ohio.*

National Cash registers, accounting and adding machines are universal business necessities. A controlling influence on their high quality and economical availability is efficient selection and use of basic production materials.

*Southern's Big New Broken Arc Mine on the B. & O. Railroad near Wellston, Ohio—Typical of Southern's many modern operations.*

## SOUTHERN'S ENGINEERED INDUSTRIAL COAL IS AN IMPORTANT FACTOR IN NATIONAL'S PRODUCTION OF LOW COST POWER

Substantial savings have been realized by many leading mid-western industries through SOUTHERN'S versatile ability to apply the right coal to specific requirements. . . . *SOUTHERN'S widely diversified selection* is afforded through extensive mining operations in Ohio, Western Kentucky, Indiana and Illinois.

Big producing mines with 10,000,000 tons annual capacity, tremendous reserves, assure *continuous, dependable supply.*

SOUTHERN'S coals are of *uniform high quality*—engineered to rigid industrial specifications. They are washed, precision sized and graded in the country's most modern preparation plants. Laboratory tests daily at the mine assure positive uniformity.

Equipment analysis and burning tests in your own boilers *prove application* of right coals to your particular steam producing requirements.

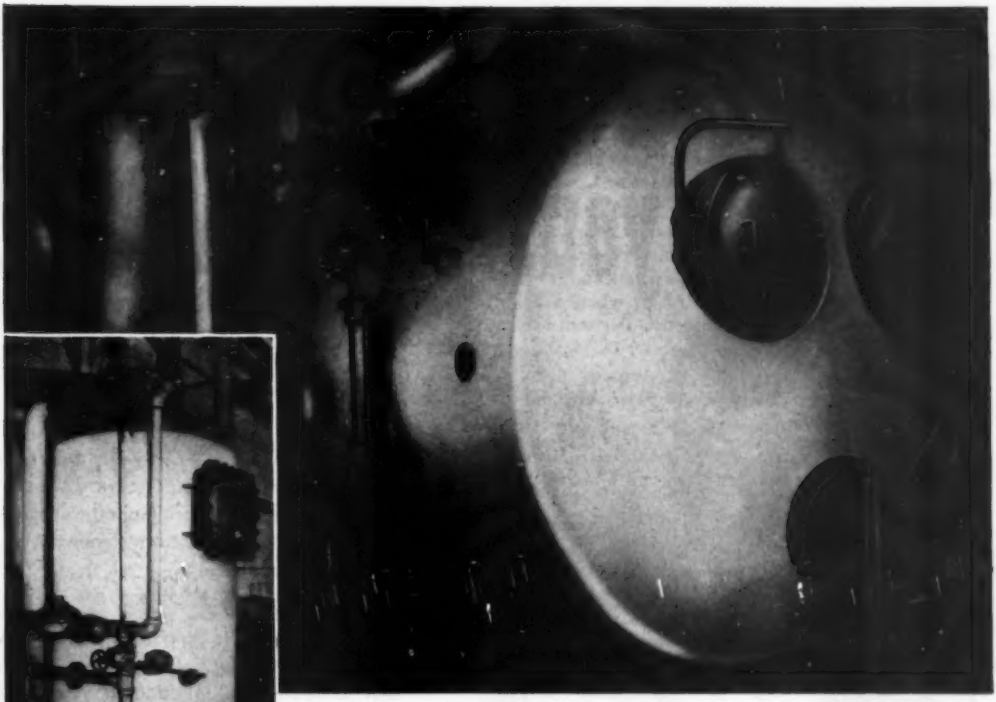
Learn today how this efficiently co-ordinated industrial coal service can lower your steam costs. Your nearest Southern office will submit recommendations and proposals based on your specific requirements.

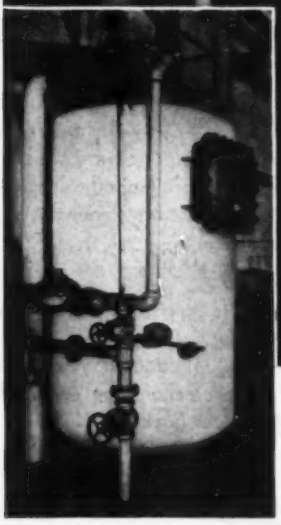
YOU CAN RELY ON SOUTHERN'S ENGINEERED INDUSTRIAL COALS

*Southern Coal Company, Inc.*

MEMBER SOUTH MISSOURI COAL OPERATORS ASS'N

GENERAL OFFICE: 333 North Michigan Avenue, Chicago 1, Illinois
OFFICES IN: Louisville, Memphis, Nashville, St. Louis
Sinclair Coal Company, Kansas City, Mo., Western Representative





# A Big Help

## on small—as well as big—deaeration jobs

Small deaerators are big business at Worthington! That's why the plant with small-capacity requirements will benefit by getting acquainted with the complete range of Worthington deaerating equipment.

### Worthington Gives You All Types, All Sizes

Worthington deaerating heaters and deaerators are built in sizes to handle from a few thousand pounds an hour to over a million. They are tailor-made to fit the particular requirements of each job. Special designs are available for operation with scale-forming water.

Both tray and steam-jet types are made—with external surface-type vent condensers or internal direct-contact vent condensing. They can be furnished for any practical operating pressure—constant or variable—or for vacuum operation.

With a complete range of sizes and types at their fingertips, Worthington engineers can competently recommend the design best suited to *your* requirements.

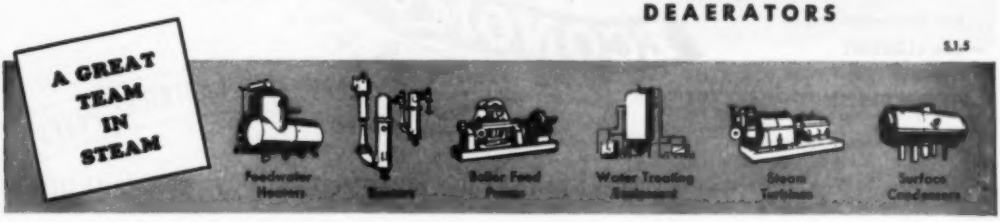
Remember, too, Worthington designs are backed by over 50 years experience in the design and manufacture of direct contact feedwater heaters and over 100 years experience in hydraulic machinery.

Send your water treating problem to Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N. J.

**WORTHINGTON**

**DEAERATORS**

S-1-5



# as easy as putting a blade in your safety razor!

...for fuse economy —use ECONOMY RENEWABLE CARTRIDGE FUSES!

Whenever you have an electric current "blow", you restore your "ECONOMY DE-LAY" Renewable Fuse to its original efficiency by inserting an "ECONOMY DE-LAY" Renewal Link, in the same cartridge.

This replacement is quick, easy and economical. Takes only a few minutes. Costs only a few cents. In addition you have time-tested fuse protection, *the result of "know how" that goes back to 1911.*

Conserve Precious Brass and Copper

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

*Ask for the* ECONOMY *Catalog and Price List.*

ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

**ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS**
REPRESENTATIVES IN ALL PRINCIPAL CITIES

# STOP RUST! with RUST-OLEUM®

**The Practical Coating!**
**Beautifies As It Protects!**
**In All Colors, Aluminum and White!**

Cut maintenance costs. Apply RUST-OLEUM directly over rusted surfaces without removing all the rust! Just wirebrush and use sharp scrapers to remove rust scale and loose particles, then apply by brush, dip, or spray. Costly sandblasting and chemical precleaning are not usually required. Specify RUST-OLEUM for every rustable metal surface. Prompt delivery from Industrial Distributors in principal cities.

**RUST-OLEUM CORPORATION**
2473 Oakton Street, Evanston, Illinois

**FREE SURVEY:** A RUST-OLEUM specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest RUST-OLEUM distributor, or write for literature on your company letterhead.

*Protects Tanks, Girders Fences, Stacks, Metal Sash, Roofs, Buildings, Marine and Railroad Facilities*

Stopping Rust with RUST-OLEUM 769 D.P. Red Primer

Look for this label. Be sure it's genuine RUST-OLEUM!

**CLIP THIS TO YOUR LETTERHEAD**
**MAIL TO: RUST-OLEUM CORPORATION**
2473 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call
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# "Moving" examples of **Flexible Connector jobs**

**EXTENSION "FINGERS" FOR TIGHT SPOTS** Have you ever dropped a screw or small part in a tight spot where your own fingers can't get at it? Then you'll appreciate these mechanical "fingers" which work around corners, even in a figure "s." They stay put, they grip and twist. Made by Aircraft Specialties, Inc., Lapeer, Michigan, from American 7/32 in. I.D. Lamp Arm Tubing.

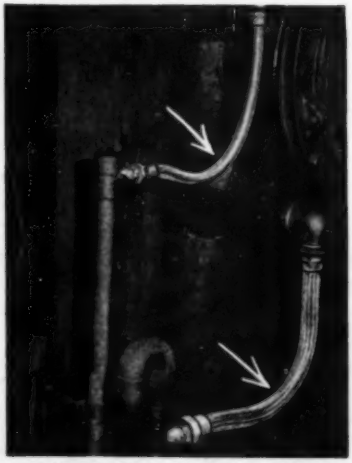
**The right move** is to use American Flexible Metal Hose or Seamless Tubing wherever connectors must be flexible, absorb vibration, stand punishment of almost any kind. For close connections, for misaligned ports, for resisting heat, pressure and corrosion, let us suggest the right connector for the job.

Bulletins SS-50 and CC-300 contain information you ought to have about these versatile products. For your copies, write The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

***wherever connectors must move...***

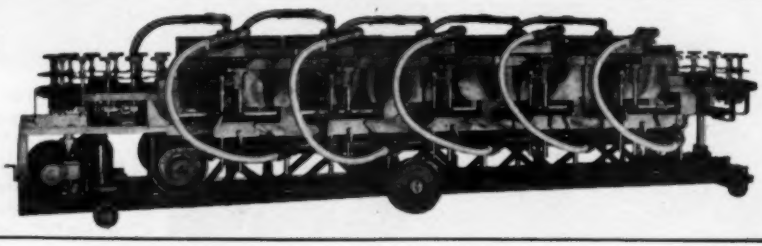
American ANACONDA

**FLEXIBLE METAL HOSE AND TUBING**



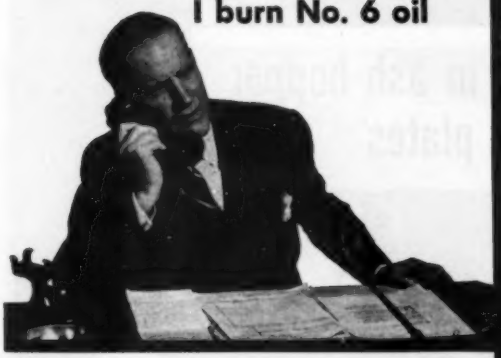
**MOVES WITH VIBRATION** — Lubricant is carried under pressure through 1-in. and 2-in. American Flexible Metal Hose Connectors to bearings and rolls of this 18-in., 4-high rolling mill. Vibration can never break these connectors.

**TO "COOK" A SMOOTH DISH** — American Flexible Metal Hose conveys gas to burners of this A. B. Knight glazing and polishing machine for finishing pressed tumblers, plates and dishes. Flexible connectors permit burner adjustment to products of varying size and shape.



1.

**That's right!**
**I burn No. 6 oil**



2.

**No, not a bit of trouble!**

3.

**Yes, it's a Preferred.**
**They specialize . . .**

4.

**. . . in fully* automatic operation with residual fuels!**

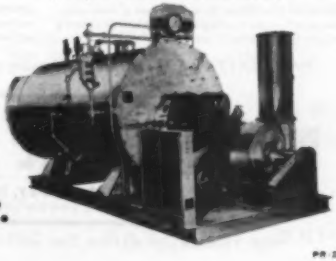
That plant engineer is only one of hundreds who label us specialists in *fully* automatic operation with residual oils. We're proud of the title, of course, for we achieved what many folks said couldn't be done. But, actually, we at Preferred like to be thought of as all-around experts in combustion problems. Witness the complete Preferred line of gas, combination oil-and-gas and light oil-fired steam generators.

We tackled and solved the problem of residual oils, because we knew we could cut your production costs by $3,000 to $35,000 a year by reducing fuel costs. Scores of Preferred customers have already pocketed these savings. Like the engineer on the 'phone, they are burning No. 6 oil with *fully* *automatic operation.

If you are now using more expensive grades of fuel, discuss your installation with a Preferred representative or write for Bulletin 175 about the Preferred Horizontal Rotary Oil Burner and Bulletin 1000 which describes the Preferred Unit Steam Generator.

*What We Mean By *Fully Automatic* Operation

- Starts *automatically*
- Ignites *automatically*
- Starts at low fire and follows load *automatically*
- Shuts off, cleans and purges itself *automatically*.



**PREFERRED UTILITIES MANUFACTURING CORP.**
**1860 BROADWAY, NEW YORK 23, N. Y.**

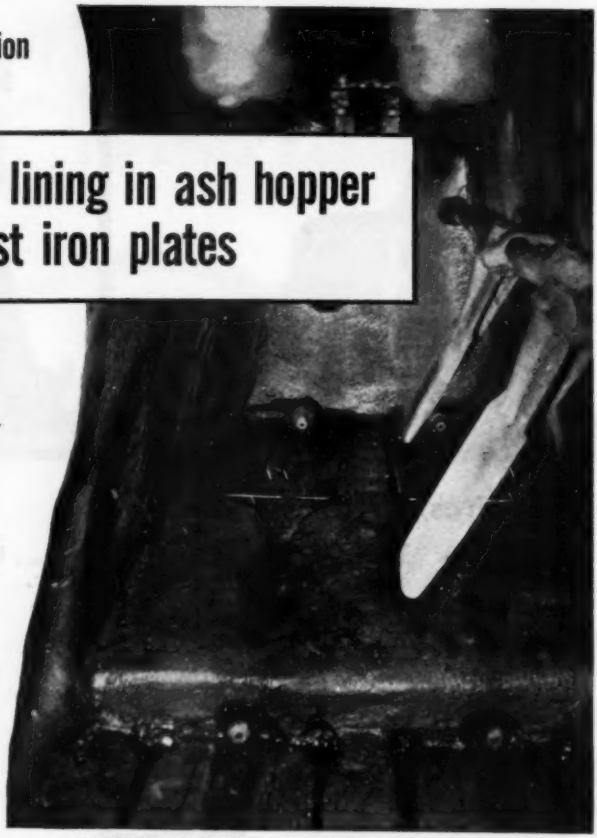
PR 204

## Westinghouse Electric Corporation finds that . . .

# Low-cost LUMNITE* lining in ash hopper outlasts cast iron plates

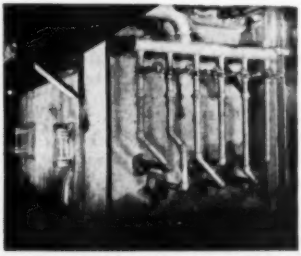
**Instead of replacing** cast iron plates on this ash hopper, Westinghouse engineers simply specified a 2" lining of Heat and Corrosion-Resistant Concrete made with Lumnite cement. They've found it does a job fast . . . costs *far less* than new plates . . . and lasts much longer. In fact, they're so well pleased with Lumnite they now use it to line all their ash hoppers.

Does their experience with Lumnite cement suggest profitable uses to you? It's proved to be a better way to line stacks, breechings and flues . . . make coal bunkers, ash pits . . . cast door linings, water wall studding and baffles, and make many fast repairs. Concrete made with Lumnite calcium-aluminate cement reaches service strength within 24 hours. With appropriate aggregate it withstands heat of 2600°F. or more, and it's highly resistant to abrasion, corrosion and thermal shock.



**THIS GIANT ASH HOPPER** at the East Pittsburgh, Pa., power plant of Westinghouse got its durable lining of Lumnite concrete in a hurry. Lining was simply shot on with a cement gun.

**CAST IRON PLATES** on this ash pit were a major maintenance item—until Westinghouse used Lumnite concrete linings as in top photo.



**LININGS** made with Lumnite proved so successful, Westinghouse engineers specified Lumnite for this all-concrete ash hopper at the Trafford, Pa., Power Plant.

**FOR CONVENIENCE** in making Refractory and Insulating Concrete, you may prefer to buy prepared Castables. These packaged mixtures of Lumnite and selected aggregates are tailor-made to meet your specific temperature and *insulation* requirements. Add only water. They are made by refractory manufacturers and sold through their dealers.

For complimentary booklet on the many uses of time- and-money-saving Lumnite write: Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

*"*LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-63

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

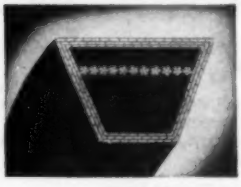
*"THE THEATRE GUILD ON THE AIR"—Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

# Dayton Cog-Belts*
# *bend* better...*are* better!

Dayton raw-edge Cog-Belts are the only V-Belts scientifically designed to bend as easily as your finger. The cogs "close up"—take up the compression as the belt goes around the pulley. Result: Less strain . . . cooler running . . . smaller pulleys . . . 40% more horsepower . . . much longer belt life.

## See HOW MUCH better Cog Belts are!

This V-Belt drive transmits the power from two diesel engines to a dredge pump, which delivers 100 cubic yards of sand and gravel per hour. The former drive used 16 ordinary V-Belts which were capable of handling 140 constant horsepower. But the dredging company wanted to step this up to 188 horsepower, to meet new production requirements. Trouble was, the increased load meant adding more belts—*and there was no room for pulleys with more grooves!* The Dayton Distributor simply put Cog-Belts on the drive. Now the same number of belts carry the increased load—and the dredge's space problem is solved. Whether *your* drive problem is *space, cost,* or *longer life,* it will pay you to look into the advantages of the Dayton Cog-Belt.



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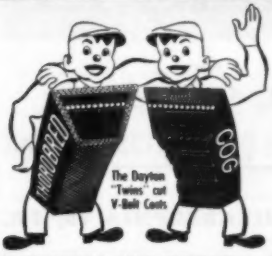
*T.M.

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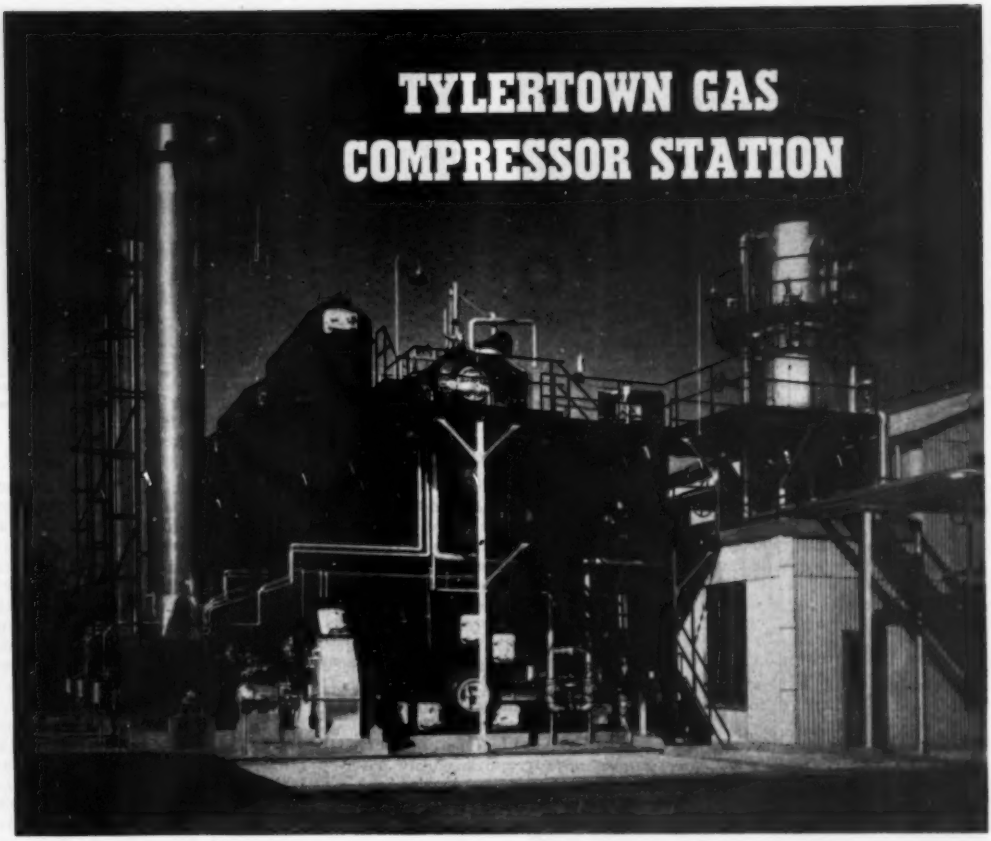
# TYLERTOWN GAS COMPRESSOR STATION



**Steam turbines are now driving gas compressors at Station No. 7 of the Transcontinental Gas Pipe Line Corp. This new plant has three steam generators, three turbine compressors, two turbine generators and auxiliaries to make up a compact package unit**

**N. W. LASSITER, *Compressor Stations Div., Transcontinental Gas Pipe Line Corp.***

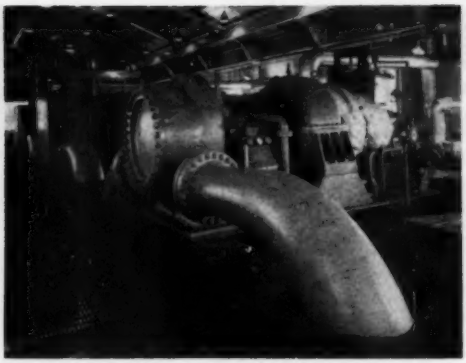
COMPRESSOR STATION No. 7, located near Tylertown, Mississippi, is one of three Transcontinental Gas Pipe Line Corporation's steam-turbine driven centrifugal compressor stations that were put into operation during the summer of 1951.

While steam turbines have been utilized extensively during the last half century for utility and industrial installations, they have never before been employed as prime movers for gas compressor stations. At Station No. 7, steam boilers, centrifugal compressors and steam turbines were installed by the design engineers in a manner that was an unusual departure from the accepted transmission pipe line practice.

Possible advantages in such a design over the conventional reciprocating engine type compressor station are: (1) lower installation cost per horsepower through the elimination of massive engines and foundations for the prime movers, (2) elimination of reciprocating parts with resulting minimum wear, vibration and pulsating gas flow, and (3) reduced operating personnel. Although fuel gas consumption will be slightly greater, the steam-turbine, centrifugal compressor station should be favorable from the standpoint of total operating and fixed charges.

The compressor station is made up of two main structures, the power plant and the compressor building. The power plant partially houses three automatically fired boilers together with two 800 kw generators, which furnish current for auxiliary equipment. The compressor building houses the three turbine-driven blowers, each of which can develop approximately 5000 hp under full load.

In addition to the two principal



*Each of these steam turbine driven gas compressors develops 5000 hp under full load. Units are connected in series*

*Two of the compressor units are now covered with insulation, the third component will be in the immediate future*

buildings, the station has a water-treating building—which houses equipment capable of furnishing a maximum of 20 gpm demineralized water—meter and regulator building, a combination office, shop and warehouse building, cooling tower and water storage facilities.

### Principal Equipment

Equipment consists of three boilers, three multistage impulse condensing steam turbines, driving three centrifugal gas compressor units, with horizontal, two pass condensers; two horizontal shaft, multistage steam turbines driving a-c generators; one 140,000 lb per hr spray type vertical shell deaerating feedwater heater; one water demineralizer; and a cooling tower.

Gas pumping equipment comprises three identical turbine compressor units for series operation. Each unit consists of an overhung, single stage, centrifugal compressor directly driven through a spacer type flexible coupling by the impulse turbine, which exhausts into the surface condenser. The condenser box structure forms the support for the turbine compressor components.

These three units are equipped with a common pressure control system that functions primarily to maintain constant station discharge pressure. It also serves to divide the load equally among the three units, thereby enabling each unit to operate in its most efficient range.

With all three units operating, the station is designed for an inlet pressure of approximately 520 psia and a discharge pressure of approximately 800. Design capacity is 603.10 MM standard cu ft per day at 60 F and 14.73 psia pressure base.

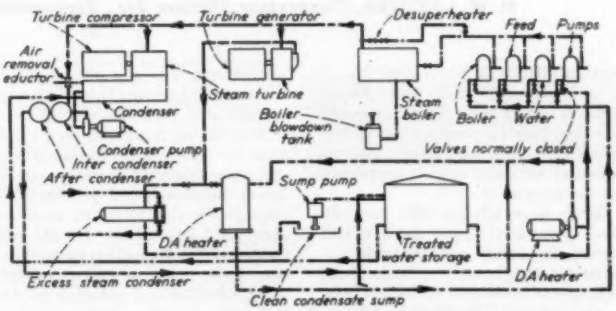
Each turbine is designed as a package unit and is provided with a hydraulic servomechanism through which the steam admission valves are operated. This hydraulic servomechanism acts in response to either of two governors. The primary governor consists of discharge pressure regulator. The secondary governor consists of an oil pump driven from the turbine shaft extension. The control system is designed so either the primary or secondary governor will control, depending upon which governor is calling for the slower speed at the time. In addition to the primary and secondary governors, each turbine is provided with a throttle trip valve and an overspeed governor.

### Cooling Unnecessary

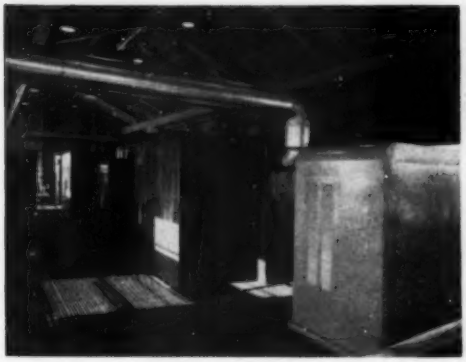
Compressors are identical in all respects. Each is a horizontal single stage, single suction machine with a 24 in. suction inlet and 20 in. discharge outlet. Dust particles and liquid entrained in the gas are passed through the centrifugal compressor without harm, thus eliminating the need for gas scrubbers. The combination of compressor station characteristics is such that discharge gas temperature is not high enough to damage pipe coating or cause undue stress in the pipe wall. Thus gas scrubbers and cooling facilities that are required at reciprocating engine stations were eliminated at this station.

### Lube System

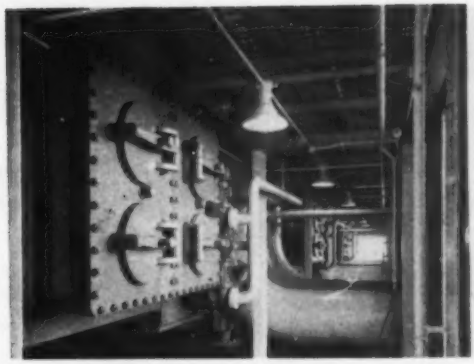
Each turbine compressor unit has a combination closed pressure oil system, which actually comprises several independent systems all interconnected. Oil is normally fed to the various bearings and control devices by the main oil pump, which is driven from the turbine shaft extension. The oil reservoir is a covered 500 gal tank mounted along the turbine under the floor plates. One section of the tank is partitioned off and baffled for degasifying oil returned from seal oil leakage.




*Flow diagram of operation indicates that the system has an exceptionally good steam balance. Only one per cent makeup water is required*



*Turbines are provided with a hydraulic servomechanism that limits the steam through a proportioning valve*



*These surface condensers act as a structural foundation for each of the turbine-compressor components*

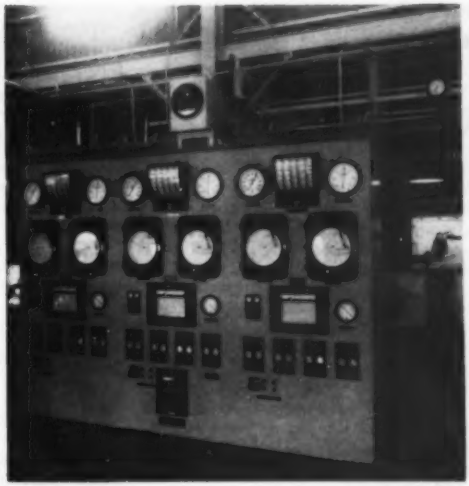
An auxiliary oil pump sends oil from the reservoir through a check valve into the discharge line of the main oil pump. Rotating speed is controlled by a pressure governor, and an oil pressure of approximately 70 psi is maintained in the main oil system. At this pressure a sufficient amount of oil is passed through the accumulator to lubricate the unit during starting and stopping operations. As soon as the main oil pump reaches a speed at which 75 psi pressure is developed in the main oil system, the pressure governor shuts off the steam supply to the turbine driving the auxiliary oil pump. Should the main oil pump be shut down for any reason, the pressure governor will admit steam to the turbine driven auxiliary oil pump so as to maintain pressure in the oil system.

### Overspeed Control

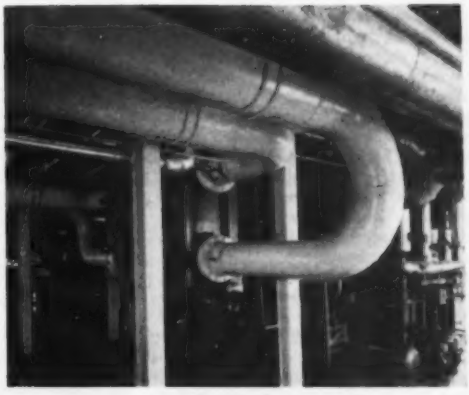
Lubricating oil is also employed to shut down the turbines in case of overspeed and to seal high pressure gas inside the cases of turbine blowers. Oil for sealing gas in the blower case is supplied by a separate motor driven gear pump, which takes suction from the lubricating oil system. This oil circulates through the seal and bearing nearest the impeller at a slightly higher pressure than that of the turbine blower gas, thus providing a positive control of blower leakage.

### Bearing Lube

A turbine driven auxiliary centrifugal oil pump is provided that supplies oil to the various bearings and control devices whenever the delivery of the main oil pump is insufficient for the operating requirements. The turbine wheel and pump impeller are mounted on a common shaft and the casings and supporting frame built one



*Boiler house control panel indicating and recording instruments, which keep a constant record of all power generating data*



*All the condenser water circulating pumps are turbine driven. Water circulation is controlled by constant pressure instruments in these condensers*

*Oil cooler, left, is part of a combination pressure oil unit for the turbine-compressor that operates at 75 psi*

*Two 800 kw turbine generators furnish electrical power for auxiliary equipment. Feedwater pumps are automatic*

into another so as to form a single unit.

### Boiler Capacity

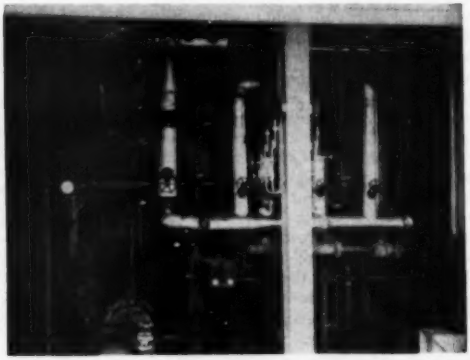
Each boiler is capable of delivering 48,000 lb of steam per hr for short period operation and 43,000 lb per hr for continuous operation at 625 psig and 750 F TT. Since demineralized feedwater is utilized, the designers made every effort to recover as much steam and condensate as possible. As a result, the total makeup for this station is approximately one per cent of the boiler steam flow.

This power plant was designed with as many automatic features as practical in order to minimize operating labor. Fuel gas and air supplied to the firebox and feedwater supplied to the boiler are automatically adjusted to varying load conditions in order to maintain constant steam pressures. Greater fuel economy can be achieved with this automatic control than by hand operation.

### Steam Control

An indicating pressure controller located in the outgoing steam supply line is the master instrument in this hookup. Any fluctuation in load conditions is first indicated by a steam pressure change. Thus, the pressure controller performs the first step in adjusting boiler output to the load.

For example, a sudden increase in load will cause a decrease in steam pressure. The instrument will automatically increase the flow of fuel gas and air to the combustion chamber. Additional combustion causes increased pressure in the firebox, and the induced-draft damper is automatically opened, allowing combustion products to flow to the boiler stack. An automatic valve allows more feedwater to flow to the boiler to compensate for increased steam demand. As more steam is generated, a controlled amount of water is fed to the de-superheater to maintain temperature. Thus the boiler automatically adjusts itself to the increased load conditions. As a result of the extensive automatic design, only one man is required to operate the entire power plant.



*Air ejector equipment for each surface condenser is identical. All primary pumping units are driven by means of steam turbines*

These are some of the basic features of the first steam-turbine driven centrifugal compressor installation in the natural gas pipe line industry. The station has not operated for a sufficient length of time to evaluate the merits of this type of equipment as compared with other prime movers. Extensive studies are being made now and such comparative information will be available for publication in the future.

**LIST OF PRINCIPAL EQUIPMENT**

| | |
|---|---|
| Boilers | Riley Stoker Corp. |
| Gas compressor | De Laval Steam Turbine Co. |
| Gas compressor steam turbine | De Laval Steam Turbine Co. |
| Gas compressor condenser | Allis-Chalmers Mfg. Co. |
| Generator | Ideal Electric & Mfg. Co. |
| Generator steam turbine | De Laval Steam Turbine Co. |
| Feedwater heater | Elliott Co. |
| Demineralizer | Cochrane Corp. |
| Cooling towers | The Marley Co. |
| Gas pressure controls | Askania Regulator Co. |

# RECENT MOTOR CONTROL DEVELOPMENTS FOR FREQUENT STARTS AND REVERSALS

**Frequently, improvements in equipment characteristics are initiated by one industry to the advantage of others. These methods may become important wherever relatively heavy loads are started or reversed often and rapidly**

**L. W. HERCHENROEDER,** ***Industry Engineer***
***Westinghouse Electric Corporation***

EACH YEAR brings its quota of new developments in the electrical industry. Here is a discussion of the interesting features of three of them—an adjustable-voltage planer drive, an experimental ignitron contactor control for an induction motor, and a study of the use of d-c dynamic and capacitor braking for reversing induction motors and their loads rapidly.

## Adjustable Voltage Drive

The adjustable-voltage planer drive has been redesigned recently to take advantage of advancements during the past few years. A major change has been made in the fundamental circuit by using a rotating regulator of new design, instead of the bridge type used in the past. It provides greater forcing of the generator field during reversal of the drive, and permits considerable reduction in the thermal capacity of the speed-control rheostats.

Fig. 1 shows the bare elements of the scheme, with relays and other items not pertinent to the discussion omitted. The generator and motor armatures are connected solidly together. Creeping in the "off" position is prevented by means of a generator suicide field, not shown on the diagram. The entire field of the generator is supplied by the regulator. This has two advantages:

1. Forcing of the generator field during reversal is easily obtained.

2. The speed control rheostats may be placed in the regulator fields instead of in the main generator field, thus effecting a considerable reduction in rheostat rating for the system.

The regulator has four fields, two pattern windings for the cut and return directions, a voltage field, and an anti-hunt field. Potential across the voltage field is determined by a combination of the drop across the resistor R and the drop across the generator and motor commutating coils. By proper adjustment of the tap on resistor R, the voltage may be made proportional to the counter emf and, therefore, speed of the d-c motor. Under steady running conditions, voltage and anti-hunt fields are differential with respect to the pattern field, and the net excitation on the regulator is that provided by the pattern winding minus the anti-hunt and voltage fields.

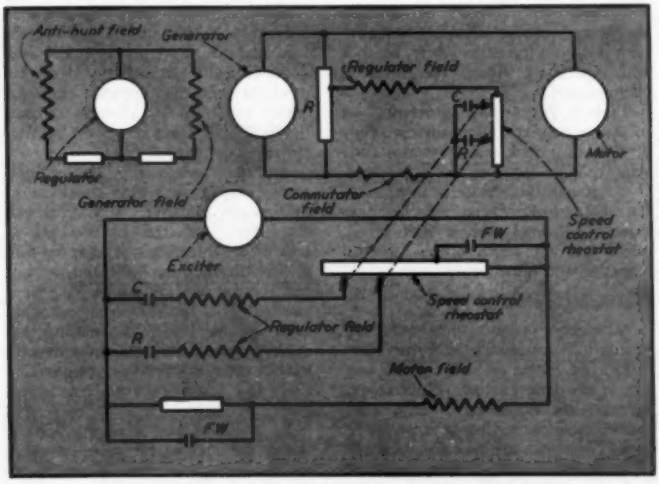



**TABLE I—COMPARATIVE REVERSING RATES FROM 1200 RPM TO MINUS 1200 RPM**

| Type | Reversing time, sec | Short strokes per min |
|---|---|---|
| Constant voltage, 200-1200 rpm drive | 3 | 20 |
| Old adjustable voltage drive | 2 | 46 |
| New adjustable voltage drive | 1.35 | 54 |

***Fig. 1 (left)—Supplying the generator field entirely from the rotating regulator speeds response, reduces size of rheostats. Reversal speed can also be increased by a lower rotor inertia***

Presented at the 15th Annual Machine Tool Electrification Forum; April, 1951; sponsored by Westinghouse Electric Corporation.

No self energizing winding is used. This increases the speed of response considerably, and aids field forcing of the main generator for rapid reversal of the drive.

Speed range of the drive is from 40 to approximately 800 rpm by armature voltage control, and 800 to 1200 rpm by motor field control. The speed control rheostat has an element in series with the pattern field and another in series with the voltage field. The section in series with the voltage field is shorted out at minimum speed to provide maximum sensitivity for that winding at low speed, which results in good regulation. As the speed setting is increased, pattern field current is increased, while resistance in series with the voltage field remains constant. After full current is reached in the pattern field, voltage field resistance is increased until full generator voltage is obtained. Thus, maximum sensitivity of the voltage winding is obtained at low speed without requiring excessive power in the pattern field for the high speed settings.

### High Speed Operation

The motor field element of the speed-control rheostat has been eliminated by reducing the current in a single step. To obtain speeds between 800 and 1200 rpm, it is necessary to recalibrate the generator voltage at the same time that the motor field is weakened. This is accomplished by an interlock on the speed control rheostat, and by a voltage relay connected across the generator armature. Contactor FW, Fig. 1, has a contact across the field-weakening resistor, and also a contact across a portion of the speed-control rheostat in series with the pattern field. Contactor FW is controlled by the voltage relay and an interlock on the speed-control rheostat. FW is energized for speeds below 800 rpm and de-energized for speeds between 800 and 1200 rpm. The interlock on the speed control rheostat is open for settings below 800 rpm, and closed for those above.

Assume that the speed control rheostat is set for 1000 rpm, and the pattern field is energized to accelerate the drive. The rheostat interlock is closed, but since there is no generator voltage, the voltage relay is de-energized and FW is energized, giving full motor field. When generator voltage builds up to approximately full value, the voltage relay is energized, which drops out FW, thus weakening the motor field, so that 1200 rpm would be obtained if full generator voltage were maintained. However, FW also inserts resistance in series with the pattern field so that generator voltage is reduced to a value giving 1000 rpm.

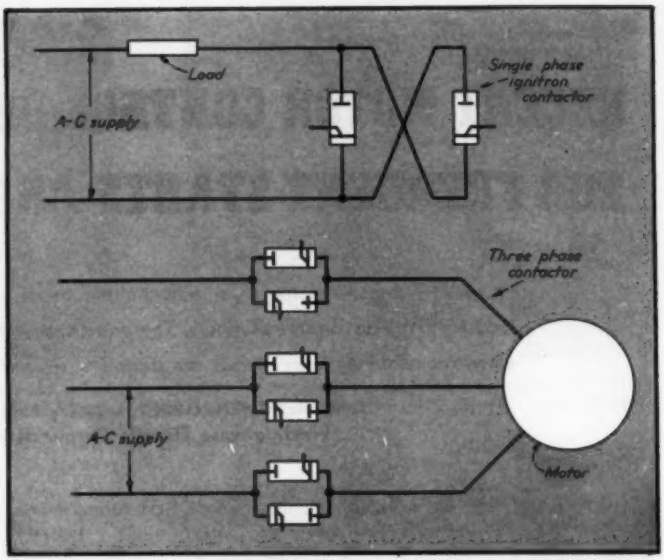



*Fig. 2—The original ignitron contactor shown in a single phase circuit above has been adapted to three phase operation on induction motors. Principal development is addition of a holding anode, (not shown) to allow for power factor phase shift*

One of the most desirable characteristics of a planer drive is rapid reversal, which depends on the ability to reverse generator voltage rapidly. One limitation is ability of the motor to follow the reversal of voltage with suitable commutation. The torque and, therefore, the armature amperes required to reverse the motor depends on the $WK^2$ of the motor and load. Since the motor may have roughly 50 per cent or more of the total $WK^2$, considerable improvement can be obtained by reducing that value. Motor $WK^2$ has been lowered by using a longer and smaller diameter armature with forced ventilation. Split brushes with individual fingers have improved commutation.

Table I shows the improvement in reversing time and short strokes as industry has progressed from the constant voltage drive, to the old adjustable voltage, and now to the new drive. For short stroke operation, the new drive is provided with a short stroke selector switch which opens up the regulator anti-hunt field.

### Ignitron Contactor

A-c motors for short duty cycles are getting to be of considerable size. Normally, the motor is considered the critical element in such applications; but when the motors are large, control also becomes somewhat of a problem. Small contactors can take frequent applications of starting current without undue difficulty, but large units often cause trouble on short duty cycles because of mechanical pounding—as well as contact maintenance due to the high currents involved. In an attempt to solve this problem, an ignitron contactor has been developed for use with squirrel-cage motors.

### Design and Circuits

Ignitron contactors have proved themselves over a number of years in welding applications. Fig. 2 shows a simple unit at the top of the drawing. The two ignitron tubes are connected back-to-back, and in series with the load and the a-c supply. One tube conducts in one direction and the other conducts on the opposite polarity, which results in a-c current through the load. For simplicity, the ignitor circuit is not shown.

At the bottom of Fig. 2 is an ignitron contactor for a three-phase induction motor. It can be seen that two tubes are connected back-to-back in each of the three lines. Again, for simplicity, the ignitor circuit and the circuit for the holding anode have been omitted. This application is somewhat more difficult than for welding because power factor of an induction motor changes over a considerable range as it accelerates from zero to full speed.

To accommodate changing power factor, the ignitron tubes are provided with a holding anode in addition to the

main anode. The ignitor circuit is timed to initiate an arc to the holding anode at phase angle suitable for the highest power factor of the motor. This keeps the tube ionized so that it is ready to conduct the motor current reverses.

An experimental unit has been installed on a direct drive press, and kept in operation for several months. The motor is of the squirrel cage type, rated 7000 lb-ft torque, 20 poles, 440 v, 3 phase, 60 c. It is roughly the equivalent of a 250 hp motor, and has been designed for starting 8 times per min. Performance of the drive has been quite satisfactory after the customary adjustments necessary with experimental installations were made. A true evaluation of the control must await further operating experience, as added cost of the ignitron contactor must be balanced by less maintenance and increased reliability.

## Dynamic and Capacitor Braking

Obtaining more reversals per minute from squirrel cage motors on reversing duty cycles is an ever-present problem. High rotor resistance, reduced $WK^2$ of the motor and load, and special rotor construction for added heat dissipation are means frequently taken to obtain more reversals. In an attempt to find other means, a study was made of d-c dynamic and capacitor braking.

It is well known that rotor loss, Fig. 3, while accelerating a pure inertia load is equal to the mechanical stored energy in the rotating parts at synchronous speed. Also, losses in the rotor while plugging to a stop are three times the mechanical stored energy of the rotating parts at synchronous speed. Thus in plug reversing, the major part of the rotor losses occurs while plugging from minus synchronous to zero speed.

With d-c dynamic braking, the total losses are equal to the mechanical stored energy in the rotating parts, plus loss in the stator due to d-c current. Losses with capacitor braking cannot exceed the change in mechanical stored energy, since this is the only source of power. In addition, much of the loss may be dissipated in an external resistor. It was, therefore, felt that increased reversals could be obtained with the same temperature rise by using either capacitor braking or d-c dynamic braking and then plugging, instead of plugging over the complete reversal.

To test the theory, a setup was made in the laboratory using a standard NEMA design B, 1 hp, 4 pole, 220 v, 3 phase, 60 c, squirrel cage motor. Heat runs were made with various numbers of no load reversals per minute for (a) reversing by plugging, (b) d-c dynamic braking and (c) capacitor braking. Tests were made on capacitor braking both with and without a loading resistor. The current used for d-c braking, was 16.4 amp applied to two leads of the wye connected motor. The capacitor braking circuit consisted of two 60 mfd units connected in open delta across the motor terminals. For capacitor braking with resistor loading, two 47 ohm resistors were connected across the capacitor terminal studs.

## Heat Test Results

Results of the test are plotted in Fig. 4. Capacitor braking with resistor loading gave the best results, permitting approximately 50 per cent more reversals per minute with the same temperature rise in the range between 40 and 50 C rise.

The increase in reversals per minute must, of course, be paid for by the added cost and space requirements of capacitors, resistors and control.

The added control depends on details of the reversing system. As a minimum, a contactor is required for the capacitors and resistors, and a timing relay is necessary for timing the braking period. In general, it appears that the extra cost of capacitor braking can be justified when the reversals per minute or the load $WK^2$ are greater than can be handled by the use of a special motor with a high resistance rotor. There will be cases, however, where personal preference for a standard motor or long delivery on a special motor will indicate the use of capacitor braking for a specific application.

## Consistency of Braking

For the 1 hp motor used for the tests, two 60 mfd capacitors were connected in open delta across the motor terminals. Braking could be obtained with only one capacitor, but it would be somewhat erratic because it depends on what point of the voltage wave that connection is made. It is more consistent when two units are used and three are even better. The greater the number of units, the smaller they may be for a given standard of results.

The rating of the capacitors may be roughly double that of the motor. Consequently, if they were left across the line continuously, the power factor would be low in the leading direction. Normal procedure would be to switch the capacitors for the braking operation, rather than permanent hook up.

The 47 ohm loading resistors were connected directly across the capacitor terminals, one for each unit. They provide much better braking at little additional investment for equipment.

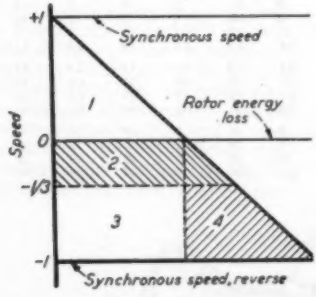



**Fig. 3—Starting losses equal kinetic energy at synchronous speed. Braking and reversal losses vary with method**

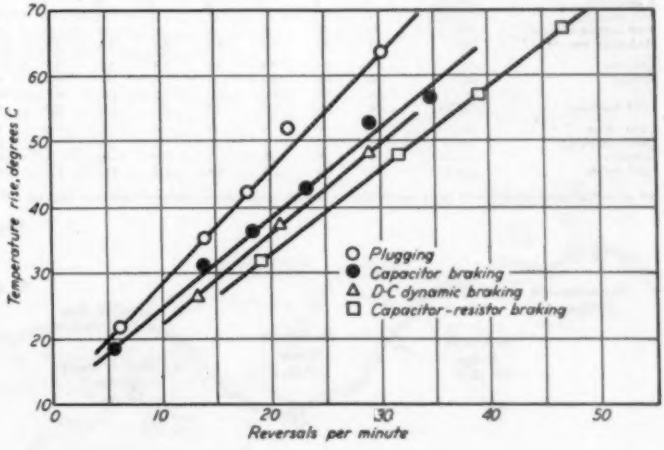
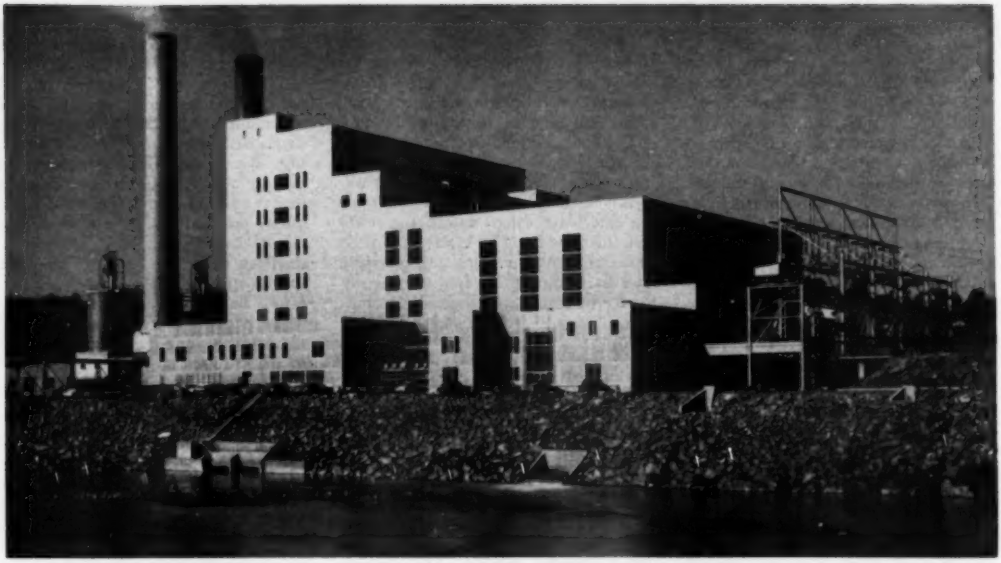



**Fig. 4 (right)—For a given temperature rise, number of reversals per minute is increased as motor losses are reduced, curves are for a 1 hp motor**



# WATER CONDITIONS AND WATER CONDITIONING AT TITUS

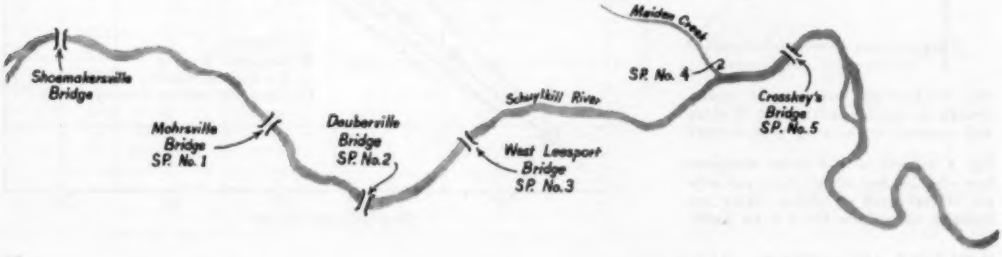
**Contaminants in the Schuylkill River, sole source of water for the new Titus Station, created numerous problems. Treatment system design was based on water quality analyses provided by a comprehensive sampling program**

**N. C. STRATTON, *Water Service Engineer, Gilbert Associates, Inc.***

**TABLE 1—ANALYSES OF WATER SAMPLES FROM THE SCHUYLKILL RIVER AND ITS TRIBUTARIES NEAR READING, PA.**

| Sampling point | Symbol | 1 | 2 | 3 | 4 | 5E | 5W | 6E | 7 | 8 | 9 | 10E | 10W | 11E | 11W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P alkalinity | $CaCO_3$ | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | Tr. | 0 | 0 | 0 | 0 |
| MO alkalinity | $CaCO_3$ | 1 | 3 | 3 | 55 | 7 | 3 | 5 | 76 | 4 | 116 | 5 | 70 | 12 | 82 |
| Free carbon dioxide | $CO_2$ | 42 | 40 | 36 | 0 | 19 | 30 | 13 | 13 | 11 | 0 | 12 | 5 | 6 | 5 |
| Hydrogen ion conc. | pH | 4.2 | 4.3 | 4.3 | 8.8 | 4.6 | 4.4 | 4.8 | 7.1 | 5.1 | 8.8 | 5.1 | 7.4 | 6.5 | 7.6 |
| Chloride | Cl | 7.4 | 5.4 | 4.4 | 3.4 | 5.4 | 3.9 | 3.9 | 7.4 | 5.4 | 5.4 | 7.4 | 5.9 | 5.9 | 6.9 |
| Sulfate | $SO_4$ | 168 | 165 | 163 | 19 | 116 | 151 | 123 | 46 | 123 | 23 | 119 | 63 | 115 | 50 |
| Iron | Fe | 0.4 | 0.6 | 0.6 | 0.2 | 0.2 | 0.6 | 0.3 | 1.1 | 1.7 | 1.0 | 1.5 | 0.9 | 0.8 | 0.8 |
| Total hardness | $CaCO_3$ | 138 | 137 | 136 | 90 | 126 | 137 | 127 | 94 | 128 | 151 | 132 | 146 | 126 | 145 |
| Color—true | —— | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 20 | 0 | 10 | 0 | 0 | 0 | 5 |
| Color—apparent | —— | 5 | 5 | 5 | 10 | 15 | 5 | 5 | 35 | 5 | 25 | 10 | 25 | 20 | 30 |
| Turbidity | —— | 5 | 10 | 10 | 5 | 20 | 20 | 15 | 35 | 20 | 30 | 20 | 25 | 20 | 20 |
| Total solids | —— | 270 | 252 | 261 | 104 | 223 | 257 | 215 | 186 | 212 | 214 | 227 | 209 | 209 | 197 |

All analytical data expressed in parts per million by weight except pH values and Langelier Indices.

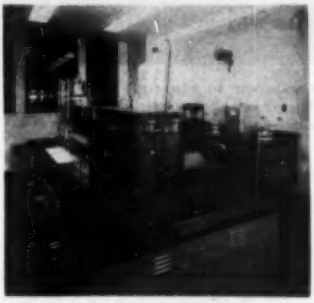


METROPOLITAN EDISON CO., faced with continuous augmentation of peak loads and energy consumption, found it necessary in the middle 1940's to appreciably increase their electrical generation facilities. Analytical studies of the network demonstrated the necessity of substantial capacity additions in the vicinity of Reading, Pa. The only circulating water source of adequate magnitude in this area is the Schuylkill River, which serves the 103,000 kw capability Eyler Station, that lies southwest of the city of Reading. This station was started in 1910 and reached its current capability in 1942. Almost the entire flow during low water is required for condensing purposes at this site, and practically all generating capacity was continuously needed. These conditions forced selection of a new plant site.

Consideration of various sites and detailed studies of their potentialities ultimately led to choice of the present Titus Station site. A 27 acre plot was selected on the west bank of the Schuylkill River approximately two miles south of Reading. This site is served by both the Reading Co. and Pennsylvania Railroads and Pennsylvania State Highway No. 83. The plant is adjacent to the South Reading Substation, which lies on the 110 kv double circuit electric transmission line, backbone of the Meco transmission system extending from the Susquehanna River on the west to the Pennsylvania-New Jersey border on the east. There were obvious advantages in locating the new station adjacent to this transmission line; a principal substation and the geographic load center of the system.

Employing the Schuylkill River as principal and probably only source of water for the new Titus Station posed a number of problems. This water required conditioning before it would be suitable for boiler feed makeup, house service water and condenser cooling water. Treatment for the last purpose was considered unlikely since a once through system was contemplated and treatment of such systems is rarely economical. Further, sufficient condensing water for three 60,000/75,000 kw capability reheat machines operating at 1000 F and reheating to 1000 F was available; 225,000 kw being the ultimate capacity contemplated.

The Metropolitan Edison Co. had experience with Schuylkill River water dating back to 1910. The Eyler Station had employed this source for circulating water and for makeup in the early days of plant operation. Quality considerations were not important with regard to circulating water supply. House service water and boiler feed makeup were derived from Wyomissing Creek, an upland stream, which was dammed for these purposes. Early philosophy, which guided boiler feed makeup water treatment called for both external and internal treatment. Each



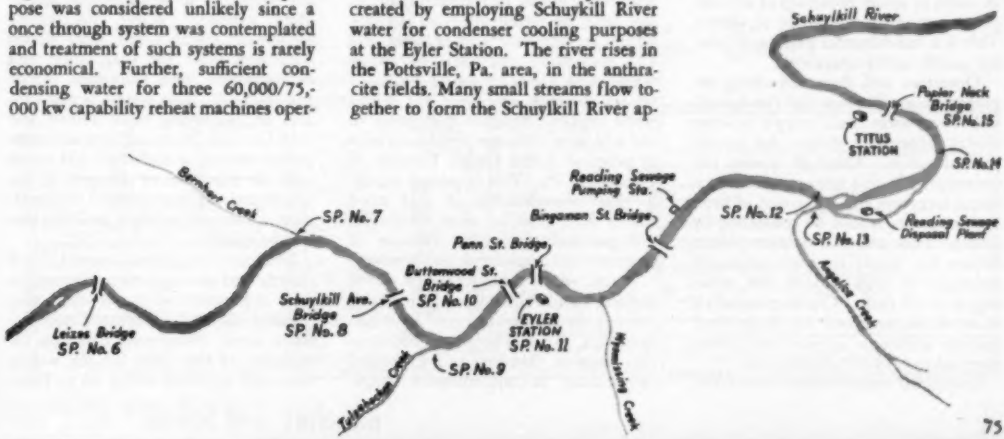
**Complete water analyses determined in the chemical laboratory provide data for control of water treatment rates**

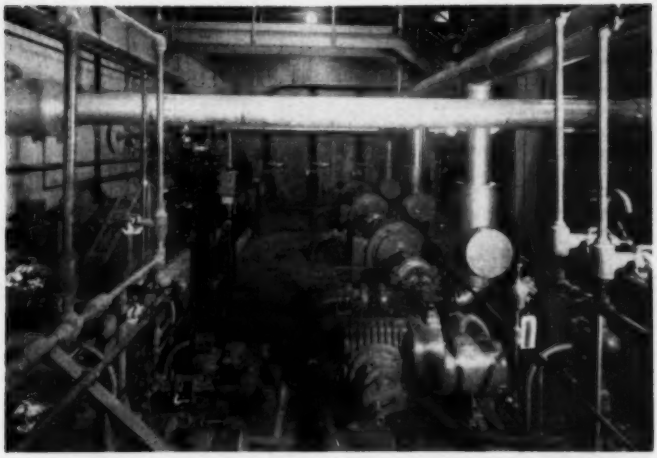
month the supply was alternated from the alkaline Wyomissing Creek to the predominantly sulfate Schuylkill River. Conditions that resulted from operation with one source of water were expected to be rectified by use of the other. Experience with this type of operation and a generally wider appreciation of water conditions and water conditioning gradually led to elimination of the Schuylkill River for boiler feed makeup.

This did not solve water problems created by employing Schuykill River water for condenser cooling purposes at the Eyler Station. The river rises in the Pottsville, Pa. area, in the anthracite fields. Many small streams flow together to form the Schuylkill River approximately 30 miles north of Reading. Originally these streams were subject to pollution from two related sources and one other source. Pumpage from mines contained sulfides, which, upon oxidation, yielded sulfates and sulfuric acid. Further, coal washeries, collieries and other preparation plants discharged large quantities of suspended matter (fine anthracite and detritus) as well as additional sulfur compounds. Third source of pollutants was sewage and industrial wastes.

Suspended solids in tributaries and the Schuylkill River caused deposits of anthracite culm and other water borne sediments to form. High river stages frequently shifted these bars and small islands bodily, sometimes with drastic results. On one such occasion within recent years, an island of culm and detritus moved into the circulating water intake of the Eyler Station, which was generating approximately 100,000 kw. Without condensing water, station output fell immediately to approximately 1000 kw and transmission line power was required to maintain operation of critical auxiliaries. Several weeks of dredging and general intake cleaning were necessary before the station could return to peak generating capacity.

The Titus Station was conceived and early planning and designs were executed while the Commonwealth of Pennsylvania was launching the Clean Stream Program under the direction of the Bureau of Sanitary Engineering of the Department of Health. Obviously the Schuylkill River needed reclamation badly and was selected as the first major project. Pennsylvania alone has spent over $30,000,000 in dredging the river, building silt deposit basins and in general rehabilitation. The Federal Government has made substantial commitments to dredge the lower reaches of the stream and has partially executed





***Chemical facilities are consolidated adjacent to the clear wells in the water treatment bay basement. The above photo and the drawing on page 77 show the compactness provided by these equipment locations***

this project. Reliable estimates indicate anthracite collieries formerly discharged approximately two million tons of silt and fine sizes of coal into the Schuylkill River system each year. Today this pollution has been stopped since water washery equipped collieries in the drainage basin have installed desilting systems. Clear water now appears in the Schuylkill for the first time.

These accomplishments were largely nebulous future planning during design stages of the Titus project. Future operation and maintenance of the Clean Streams Program was equally uncertain. The Titus Station site was located at a point where only Schuylkill River water would be available at reasonable cost. Economic considerations dictated the design of a unit type plant, in which one boiler and one turbine with associated auxiliaries constitute one generating unit. Utmost precautions must be taken to assure reliability of all components to insure continuity of service. This is a fundamental precept of electric public utility operations.

Operators and their consulting engineers were well aware that raw Schuylkill River water could cripple a steam electric generating station due to suspended solids. Although quality improvements in this respect were anticipated, inception and regulation of these improvements would be controlled by others. This meant the Metropolitan Edison Co. would have no reasonable assurance of high quality raw water supply at all times. Clarification of all water to be employed for boiler feed makeup and house service cooling was essential to prevent interruptions.

Suspended matter content consituted only one phase of the water quality problem. The river is acid, containing mineral acidity, from its source to a point north of Reading. Neutralization and appearance of a small methyl orange alkalinity content takes place below the confluences of the Schuylkill River with Maiden and Tulpehocken Creeks. The Maiden Creek drains a limestone area northeast of Reading and supplies the city with generally alkaline water. The acid point was assumed to move up and down the river depending on runoff from drainage areas.

Acid coal mine drainage is admittedly the one industrial waste, which the Bureau of Sanitary Engineering cannot cope with at this time. Sulfides mixed with water containing dissolved oxygen form sulfuric acid and ferrous sulfate. Most effective methods developed and practiced on a wide scale to control this form of pollution are: (1) sealing abandoned mines, (2) diverting drainage from operating mines to streams, which are currently acid polluted and (3) restraining operation of mines where acid drainage would pollute a stream currently employed for public water supply. Research pertaining to the acid mine drainage problem is now in progress at the Mellon Institute of Pittsburgh, Pa. They reported recently that neutralization of acid mine waters with lime or other alkalies is not practical or feasible because of economic and other difficulties involved.

Rivers, which are to serve new power stations, should be sampled periodically for one to two years prior to initial operation. This establishes concentration range of dissolved and suspended constituents. A comprehensive sampling program was instituted by the consulting engineers to provide engineering data on water quality available at the Titus Station. Samples obtained at the selected points indicated on the map, Fig. 1, provided the partial water analyses contained in Table 1.

Inconsistencies in analytical results, differences in appearance of river banks and variations in water color at different points in a cross section of the river channel were noted. This indicated that water received from tributaries was not mixing with the main stream. Newly received water from Tulpehocken Creek tended to follow the west bank. The Titus Station was on the opposite bank and, therefore, the periodic sampling point was moved nearer the plant site in an effort to obtain more accurate data.

Reading discharges sewage from a pumping station to a disposal plant located upon Fritz's Island, south of the city. Here ground garbage was added and digestion attempted. Effluent from the disposal plant was assumed to be a function of flow rate at the sewage pumping station. Samples were taken at the station site at two hour intervals over a series of days to establish the hourly variations in concentrations of suspended and dissolved constituents. These tests demonstrated that major changes in concentration were not encountered on days when spot checks were taken. These studies were conducted through part of 1948, all of 1949 and part of 1950. Relatively complete mineral analyses were conducted on spot samples taken during the same period. These data were assembled and studied as specifications for equipment were being prepared.

Raw water contained appreciable quantities of iron and manganese, which were demonstrated to be partially in solution and partially in suspension. These materials have been known to cause difficulties through their incrustant properties in steam electric generating stations. Water conditioning equipment specifications were drawn with provisions for coagulation and neutralization with aluminum sulfate and soda ash. This system is also capable of employing ferric sulfate and lime for coagulation and iron and manganese removal at high water pH values with the minimum of changes. If future experience demonstrates this treatment is necessary, suitable modifications will be made.

Mechanical engineers assembled and summarized data covering intermittent and continuous demands for raw, clarified, filtered, disinfected and softened water. Plans were based on installation of two units initially with a third unit to follow within 10 yr. How-

ever, construction of the final unit is now underway with initial operation expected by 1953. Obviously, the most economical design was to install all raw water treatment facilities at one time rather than in three separate steps.

Much processed water is employed for cooling purposes and quantity required increases as temperature rises. Water temperature may range from 32 to 95 F with average approximately 55. Cooling water demand was ultimately estimated at 2100 gpm, part of which was diverted for filtration and sodium cycle zeolite softening before entering evaporators for distillation of makeup. Specifications were drawn for the following equipment:

6 — Dry chemical feeders
2 — 2100 gpm high rate of treatment basins
3 — 100 gpm gravity filters
2 — 100 gpm zeolite softeners

A third softener has been purchased for the unit now being installed.

The high rate of treatment basins selected are of reinforced concrete construction with internal dimensions 87 ft long by 25 ft wide and 12 ft 6 in. deep. These precipitators are back flushed through their sludge headers periodically and blown off to waste. A small stream of blowoff water is directed to the photoelectronic sludge blowoff that passes the flow between a light source and a photoelectric cell. This unit is adjusted to maintain predetermined sludge density in the precipitator. When a higher sludge density appears the photocell circuit operates to blow off the precipitator until sludge density falls to design level.

A clear well of approximately 10,000 gal capacity was provided at the south end of each precipitator to cushion surges in demand for clarified water. All equipment is located in the service building basement although dimensions of basins were so great that extending the northern basement wall beyond the plant proper was necessary.

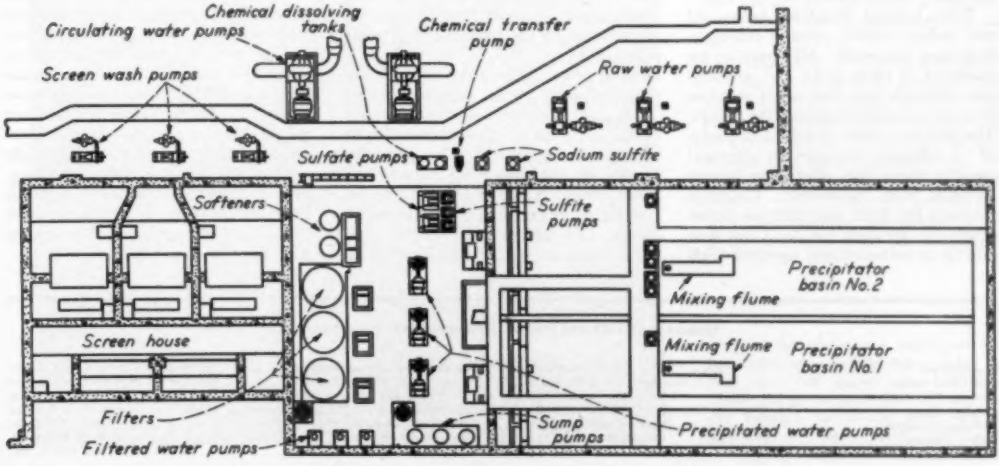
Sufficient space was provided for a complete chemical laboratory capable of analyses of water, fuel and lubricating oil and coal for control and research purposes. The area contained above the south end of the high rate of treatment basins and water treatment bay was allocated to laboratory services. The floor above, located at elevation 211 ft, was approximately four feet above the elevation of railroad tracks entering the turbine room. An unloading platform was furnished at chemical storage room level to facilitate chemical handling. A forked lift truck is employed to unload, store and transfer bagged chemicals to the open upper ends of dry chemical feeder extension hoppers, which are 2 ft above floor level in the chemical storage room. Bag type dust collectors were mounted on each extension hopper. The chemical storage room was sealed off from the station building proper to minimize the possibility of introducing dust to areas containing power generating equipment and their auxiliaries.

Dry feeders, three per precipitator, were located upon a transverse platform extending across the units. Their bins are connected to circular extension hoppers, which pass vertically upward, through the corridor adjacent to the laboratory, to chemical storage room floor. This arrangement was selected to minimize manual handling of heavy chemicals, avoid dust nuisance and centralize chemical operations. Precipitator agitator drives, control sumps, precipitated water pumps, filters and softeners were consolidated adjacent to the clear wells in the plant basement.

Rock salt employed for regeneration of sodium cycle cation exchangers is stored beneath a railroad trestle adjoining the water treatment bay. This permits purchase of salt in 40 ton box cars. Saturated brine for regeneration of softeners passes by gravity to the solenoid control valve and brine meter. When a softener being automatically regenerated calls for brine, the solenoid valve opens and brine flows until a predetermined volume has passed the brine meter. Then the solenoid valve closes and electric controls inaugurate the rinsing phase of regeneration.

The Schuylkill River at the Titus Station site possesses appreciable Biochemical Oxygen Demand and Chlorine Demand; both of which indicate that chlorination is desirable to suppress odors, organic growth and slime in surface condensers and other heat exchangers. Two chlorinators were provided. One unit, with 400 lb per day maximum capacity, feeds gaseous chlorine into the high rate of treatment basins in proportion to raw water flow. This equipment has kept precipitator basins, filters and softeners free from algae and other growth and has eliminated odor nuisance. A second chlorinator capable of feeding 6000 lb per day was procured to intermittently chlorinate surface condenser cooling water. Electrical program control actuates this air operated machine.

Recent internal examinations of the cooling water side of No. 1 unit have revealed these areas to be free from slime, organic materials and mineral deposits. The Eyler Station, located upstream, has encountered difficulties with iron and manganese oxide deposits in surface condensers. Similar deposits at the Titus Station are antici-



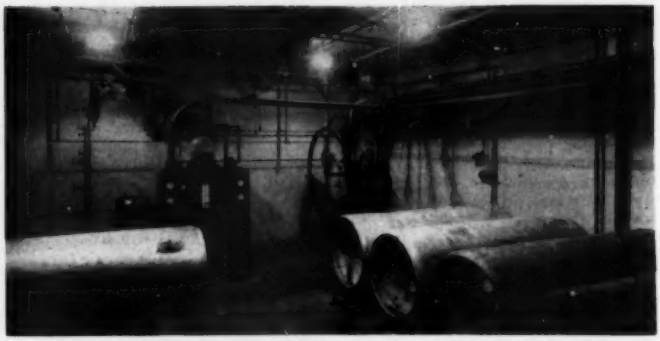
pated with some apprehension, as inspection of chlorinator working parts clearly and irrefutably demonstrates continuous presence of iron and manganese in the river water.

Secondary water conditioning is employed for treatment of boiler-turbine cycle feed. Supplementary chemical deaeration is achieved by continuous introduction of dilute sodium sulfite solution to boiler feed pump discharge piping ahead of the economizers. This location necessitates high pressure pumps of relatively low capacity. The steam generators employ direct contact desuperheaters which are supplied with high pressure boiler feedwater taken from the feed line before sodium sulfite solution is introduced. Treatment facilities are also capable of adding dilute solutions of caustic soda or organics for foam suppression and/or sludge dispersal.

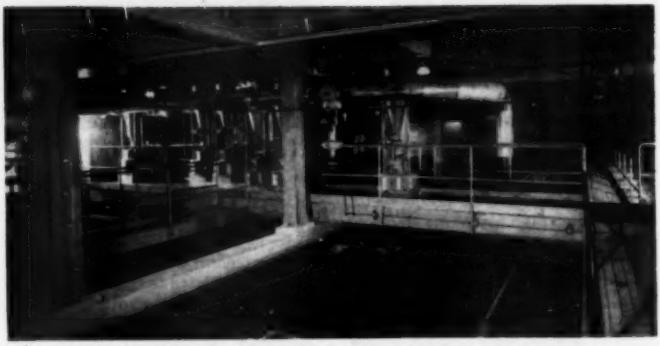
Provision has been made for pumping alkaline chemical solutions directly into boiler drums. There are two high pressure, intermittently operated pumps, one acting as a spare for the other. These pumps are suitable for handling dilute solutions of caustic soda, disodium phosfate, sodium sulfite and organics. They provide a quick means of adjusting boiler saline composition to a given analysis. Hydrostatic tests of boilers at approximately 2500 psi may be applied by these pumps.

All secondary water treatment pumps are adjustable stroke, reciprocating, positive displacement units. Protection from damage due to attempted start-ups against closed discharge valves is provided by safety heads, which rupture when subjected to excessive pressure. Discharges from these safety heads are not piped to waste or chemical solution reservoirs. Disc failure is immediately indicated by a wet spot on the floor, which cannot be ignored.

Two chemical dissolving tanks and two sodium sulfite solution reservoirs have been furnished. All chemicals are dissolved in these tanks and solutions pass through two fine mesh stainless steel screens before entering the pumps. The sodium sulfite dissolved is pumped to solution reservoirs by chemical transfer pump and diluted to desired strength with condensate. Chemical solutions for direct injection into boiler drums are similarly prepared but flow directly to intermittently operated high pressure chemical solution pump suctions. All chemical solution reservoir tanks are equipped with low level float switches, which interrupt service when solution or flushing water drops to a predetermined level. This prevents air from entering the system and protects the pumps.



*Gaseous chlorine feeds continuously into the basins in proportion to raw water flow. This treatment has prevented algae growth in precipitators, filters, and softeners, and eliminated odor nuisance*



*Manual handling of chemicals is minimized by circular hoppers that pass vertically from the storage room to six dry feeders mounted on a platform extending across the two high rate of treatment basins*

A 6 point conductivity recorder has been mounted on the turbine panel of each unit in the central control room. Once every six minutes electrical conductivity is measured. This indicates purity of the following vapors and waters for each station unit: (1) boiler saturated steam, (2) reheater outlet steam, (3) reheater inlet steam - test, (4) condenser outlet condensate, (5) evaporator distillate and (6) boiler feed water. All samples are cooled by dual helical coils prior to introduction into stainless steel conductivity cell retainers.

The forty hour work week necessitated use of automatic equipment and large solution tanks. Automatic exchange type softeners will regenerate themselves when control equipment has been properly set for prevailing water hardness. Large solution reservoirs permit chemical pumps to function continuously from 5:00 p.m. Friday night until 8:00 a.m. Monday morning. Periodic inspection by shift operators is highly desirable, however, to assure smooth, uninterrupted functioning even with automatic equipment.

**PRINCIPAL WATER TREATMENT EQUIPMENT AT TITUS STATION**

| | |
|---|---|
| Precipitators | The Permutit Co. |
| Raw water meters | Simplex Valve & Meter Co. |
| Dry chemical feeders | The Permutit Co. |
| Gravity filters | The Permutit Co. |
| Diaphragm valves | Climax Engineering Co. |
| Rotary washers | Palmer Equipment Co. |
| Sodium cycle cation exchangers | The Permutit Co. |
| Air operated chlorinators | Wallace & Tiernan Products, Inc. |
| Proportioning chlorinators | Wallace & Tiernan Products, Inc. |
| Continuous duty reciprocating chemical pumps | Milton Roy Co. |
| Intermittent duty reciprocating chemical pumps | Milton Roy Co. |
| Centrifugal chemical transfer pumps | Ingersoll-Rand Co. |
| Conductivity recorders | Leeds & Northrup Co. |
| Safety heads for pumps | Black, Sivalls & Bryson, Inc. |

# SPICER FINDS ANSWER TO LUBRICATING LARGE EXPENSIVE MACHINES

**After several extensive studies made to determine the cause of excessive down time on machine tools, Spicer Mfg. Corp. decided that 75 per cent was the result of improper and inadequate lubrication. The old method of using grease gun or oil can was not good enough to insure proper care. With this in mind Spicer went ahead to install centralized lubrication on all their principal equipment**

**R. C. LOHBAUER, *Production Engineering Staff,***
***Spicer Manufacturing Corp., Div. of Dana Corporation***

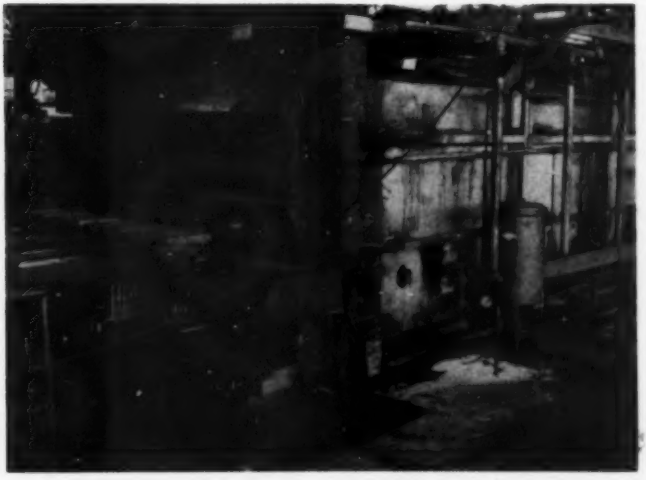
ANY discussion on the *Application of Lubricants* must necessarily begin with a true understanding of the *Meaning of Lubrication*. Many definitions have been given, the most frequent, however, is taken from Webster where it is defined "to make slippery". This is not a proper definition, and plant personnel responsible for lubrication do not approach their task with that thought in mind. They prefer to consider and define lubrication as "applying lubricants to bearings in such a manner as to maintain a constant film of oil between moving surfaces". We know that if this is accomplished we cannot and will not have bearing failures, so with that in mind we undertook a serious survey and analysis of our plant lubrication practices about four years ago and as a result have been correcting our lubricant application methods ever since.

What we found, in our survey by way of plant lubrication practices (or perhaps malpractices) and their resultant cost, was somewhat astounding. But, the savings accrued during the past four years as a result of correction of these practices are even more astounding. We find our machinery equipped with just about every type and size of grease cup, grease fitting, grease plug, oil cup, oil reservoir, wick oiler and oil hole ever designed for machinery, and, of course, that also meant a comparable array of grease guns and oil cans. It was nothing unusual to find one machine equipped with oil cups, the same identical machine in another department equipped with high pressure type grease fittings, and again a comparable unit equipped with both grease and oil fittings in still another department.

All of this meant the procurement of several different types of lubricants and lubricating equipment, which in turn greatly complicated, in fact made impossible, a lubrication training program. It further meant down time of machinery during shifts to apply these lubricants, and we found that this down time was not always used for the purpose intended. As a result, our down time for bearing replacements and machinery overhead was a very costly item.

In planning corrective measures we took several steps, all of which were aimed at one goal, to standardize practices in methods of lubricant application. This was accomplished as follows:

1. We reduced our lubricating fittings to one type only wherever possible. The type chosen was the high pressure, hydraulic type fitting with a ball in the head (flush type seal) to prevent dirt from entering.
2. This prompted standardizing on greases, grease guns, and adaptors.
3. We requested our machinery suppliers to comply with our program in



***Normalizing furnace is equipped with semi-automatic centralized lube system, and 108 points are lubricated. These points extend over all parts of the furnace in places that are impossible to reach with hand oiling***

**Semi-automatic lube systems have been installed on ten vertical turret lathes. Each has 52 points that are lubricated with an approximate saving of $1200**

the design of new machines coming into the plants, insofar as the use of the lubricating fittings was concerned.

4. We tested some centralized lubricating systems, to find one considered most adequate to our needs, and then proceeded to equip our most vital machines with this system. We made very sure, however, to compile operating cost records (case histories) both before and after installation.

Here are some of the amazing figures in cost reduction which have resulted from installation of these centralized lubricating systems.

A multiple operations index type of machine for turning, boring, drilling and reaming is a very productive piece of equipment, also very costly. We have had in operation 60 of these machines for about 10 yr. In spite of the fact that down time on these machines was excessive, causing loss of production and maintenance cost much too high, we did not become unduly alarmed until about four years ago when we became more cost conscious than we had in the past. We therefore set out to make a study to find the reason or reasons why these machines were constantly giving us trouble.

After a brief study of conditions surrounding this equipment, our findings in all cases were obvious. The tool slides were either improperly lubricated or had not been lubricated for a long period of time.

Management, up to this time placed the responsibility of lubricating these tool slides in the hands of the operator. To perform this operation they were furnished a hand grease gun, which was received as standard equipment with the purchase of every machine. For lubricating 21 points on each machine the operator received 15 min allowance each 8 hr shift.

Results of our study brought to light the following facts: Operators were receiving compensation for duties they were not performing. When questioned as to why not, we received the following answers: Could not find a grease gun, had no grease, waiting on delivery from stock room, being a new operator was not told of this duty, and fittings were either damaged or knocked off during tool set-ups and no order issued to maintenance department for replacement.

Now to correct this condition, we immediately started a lubrication program, whereby we relieved the operators of responsibility for point lubricating by installing on each machine a pressure type central system. The amazing results achieved are as follows:

1. We reduced our maintenance cost 60 per cent or $72,000 annually, including labor and material.

2. We immediately increased our production from these machines approximately 20 per cent (this equals a saving of 12 additional machines at a capital expenditure of approximately $816,000 plus tooling cost, etc.)

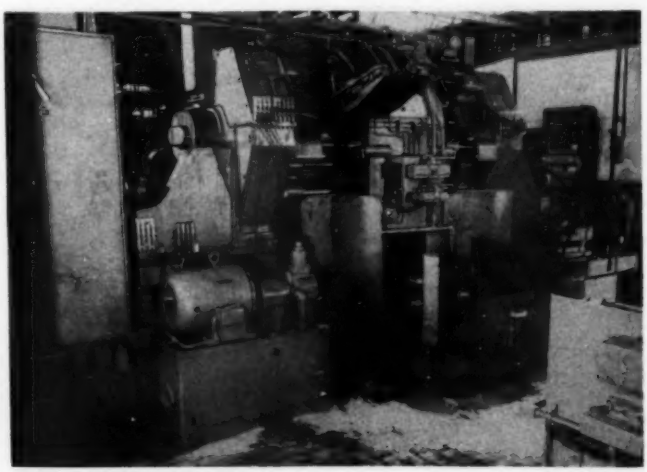
3. We are now maintaining consistently a better quality of work.

4. We received a substantial reduction in scrap, because with proper lubrication we are able to hold size and finish more consistently.

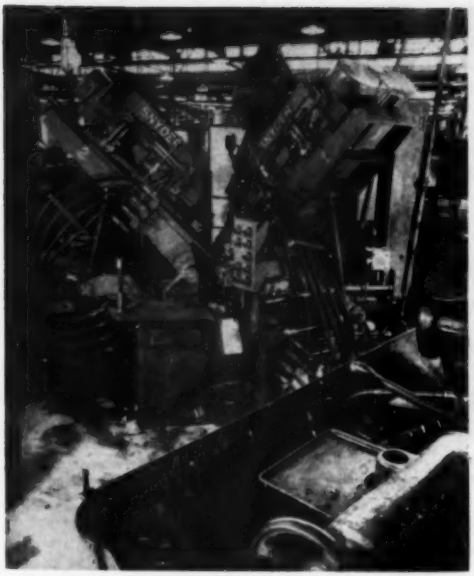
5. By installing a central pressure system, we were permitted to reduce operator's allowance for lubricating from 15 min per 8 hr shift to 2 min. This alone amounts to direct labor savings of 5 per cent per 100 pieces, or $25,000 annually.

One unit that had caused considerable trouble was an atmospheric controlled gas carburize furnace. This unit has 20 plain bearings, rack and pinion on both the furnace charge and discharge.

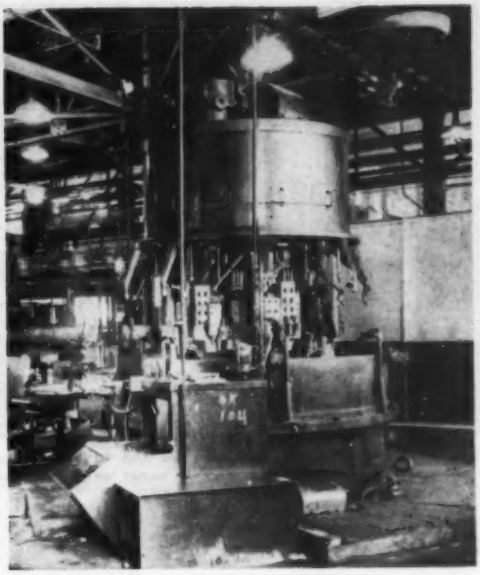
Under the original method grease



**Every moving part in this boring mill and trunion drill, 54 in number, is lubricated with a semi-automatic lube system. Three of these machines are serviced with like equipment, and results indicate a saving in repairs**



*Angular drilling machine equipped with hydraulic centralized lubrication services 18 points including moving parts*



*Multi-matic index type machine for turning, boring drilling and reaming is more productive with centralized lubr*

was applied by means of a hand gun into a manifold and out through tubing to bearing points that range from 10 to 6 in. from manifold on each end of furnace. This method proved inadequate because points close to manifold received too much grease and points more distant received none at all. With this improper method of lubrication, we found maintenance cost and down time excessive.

By installing a semi-automatic central pressure system we received the following results: (1) direct maintenance labor savings of approximately $1200 per yr, (2) savings in bearing material of approximately $600 per yr, (3) eliminated one hour per day lubricating allowances, which amounts to $580 per yr, and (4) output from this furnace has increased 13 per cent as down time was decreased.

Another example of improvement was found in the chip crusher. This unit required originally the attention of one full time maintenance man. His duties were to make minor repairs and lubricate. In spite of the fact that this unit was receiving constant attention, we were required to recondition and replace parts once every three months due to improper lubrication. This would put unit out of service for 40 hr. The cost for direct labor was $320 plus $125 for replacement parts.

After the installation of a semi-automatic central pressure system, minor repairs have not been necessary, every three-month reconditioning was eliminated and the full time maintenance man was assigned production duty.

## Present Savings

We are now realizing savings as follows: 1. $1280 annually in direct labor, 2. $500 annually in replacement parts and 3. $4667.52 by eliminating full time maintenance man.

Several machines were equipped with central pressure type lubrication systems, because we found that by hand method these machines were either improperly lubricated or received no lubrication at all. This resulted in frequent adjusting of gibs and tool slides. The annual savings realized by this change are as follows:

Five vertical turret lathes, saving in labor $425 and eliminating frequent adjustments $1200.

Five automatic turret lathes, saving in labor $324.00 and eliminating frequent adjustments $1200.

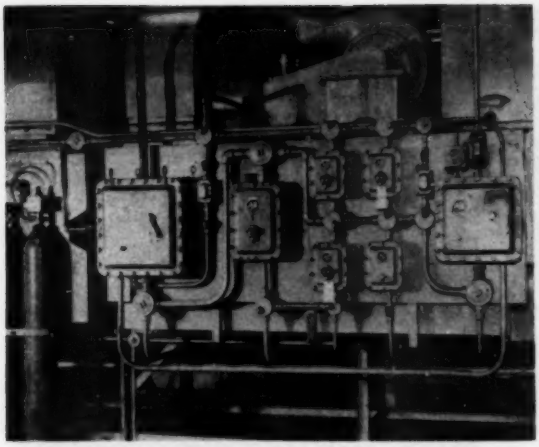
Six special precision double end boring machines, saving in labor $382.00 and eliminating frequent adjustments $1000.

Total savings realized from these 16 machines by changing from hand lubrication to central pressure type is $4530 annually in direct labor. This direct labor saving is but a very small part when compared to the increased production, reduction in scrap, better quality work and most of all the preservation of capital equipment by proper clean lubricant.

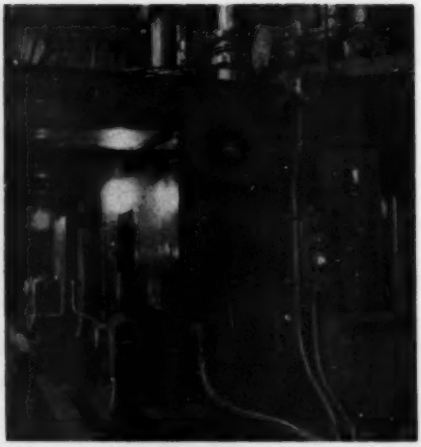
The following machines were found to be improperly lubricated by hand method, resulting in excessive wear to slide ways and bearing surfaces. Replacing hand method with central pressure system, the annual savings are as follows: (1) special deep hole drill $105, (2) vertical precision boring machine $129, (3) vertical drill and ream machine $128, and (4) special trunnion index machine $475. For these 10 machines it was costing $837 annually for improper lubrication.

Now on this basis with the number of machines in operation, we will realize a saving of approximately $100,000 annually when we replace hand lubrication with pressure type central system.

Today investigating the procedures at plants cannot help but gain the attention of top management. Tremendous savings can be accrued by organizing and following through with a service and operational program. It is all very simple and boils down to maintaining a constant film of oil between moving surfaces by applying the right lubricant at the right time and in the right quantity, by the proper method.



*Enclosures for the electrical equipment and wiring in hazardous locations may vary with the kind of vapor or gas encountered*



*due to differences in ignition temperatures and explosive force. Heat dissipation is also important*

***The How's and Why's of • • •***

# HAZARDOUS LOCATION WIRING

**Special provisions are required by the National Electrical Code for wiring and equipment in hazardous locations. Here are the important rules with their explanation and the underlying reasons**

**PAUL C. ZIEMKE**
***Safety Engineer***

ELECTRICAL WIRING for use in atmospheres that may include flammable gases or vapors would, at first thought, seem to present problems that are impracticable to solve for a positive insurance against explosions.

The problems might be stated thus: Is it possible to wire everything in a gas tight series of fittings and boxes and to avoid entrapped gas when they are opened for servicing; or to build them so strong that an explosion will throw absolutely no sparks or flame into the surrounding atmosphere?

However, the Code breaks conditions down into several classifications. Much, of course, depends on the nature of the gases or vapors.

The Code indicates that Group A covers atmospheres containing acetylene. Tremendous pressures developed by explosions of it are beyond control of the measures suggested above.

Other classifications are: Group B, hydrogen and manufactured gas; Group C, ethyl ether; and Group D, gasoline, alcohol, and natural gas. Groups C and D are most common.

The answer to the two questions is then affirmative for Groups B, C and D; while for Group A it is impractical.

Obviously, equipment must be strong enough to meet the conditions and the word, explosion proof, is justified. The Code describes it as "enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within". There is no mention of dust; it refers only to gases and vapors.

Only rigid, threaded conduit has strength to resist the forces of an explosion; and the threaded joints, with at least five thread engagements are flame tight (explosion proof). Mechanical strength and protection of threaded joints meet the mandatory requirements of Section 5014 A for Class I installations.

Two salient facts about exploding gases are a phenomenon known as "pressure piling" and the relation of volume to explosion pressure. The greater the volume of gas exploded, the greater the pressure developed. While the conduit system may be of small size there is still a large volume contained therein. It is conceivable that an explosion could rupture the walls of the conduit system.

In pressure piling, assume that the conduit is a pistonless cylinder of extraordinarily long length and that a spark ignites the gas. A compression wave rushes forward to compress unexploded gas, which will also ignite from the first explosion, but detonates with greater violence than the first explosion. This sequence recurs, and each new explosion raises the pre-ignition pressure higher with corresponding increase in the explosion pressures. The final explosion may be ten times more forceful than the initial one.

The explosion must be stopped before the wave of fire blows out into an atmosphere containing explosive or flammable mixtures. It also must be stopped where hazardous areas adjoin nonhazardous locations, since the latter's electrical installation would not withstand the force of an explosion, which could throw metal fragments endangering employees, and perhaps start a fire.

These facts indicate the conduit sys-

tem must be protected by (a) limiting gas volume, (b) preventing pressure piling, (c) preventing travel of explosions, (d) preventing movement of burning vapors from hazardous to nonhazardous areas. The Code requires seals at arcing devices such as switches, at terminal and junction boxes if the conduit size is 2 in. or larger, and for conduit runs where they connect hazardous and nonhazardous areas.

A good design calls for sectionalizing seals in long conduit runs to reduce gas volume and pressure piling.

Other special installations mentioned in the Code include grounding techniques, spray booths and communications and are self-explanatory.

## Explosion Proof Features

The task of confining explosions to the electrical system, and then releasing the pressures gradually requires strong equipment able to withstand pressures of four times the anticipated value.

Specific requirements are: (1) enclosures must be strong enough so as not to be damaged by internal explosions, (2) must have hubs threaded for conduits, (3) must not leak flames, sparks, or highly heated gases released from internal explosions and (4) must not show an appreciable rise in temperature. Not less than five threads can be in engagement at a joint to insure flame tightness and rigidity, and the mechanical strength must be sufficient to resist initial explosions.

All explosion proof cabinets must have covers to gain access to the interior for wiring and mechanical maintenance of switch parts. External operating handles pass through bearings in the walls of the cabinets. They may not leak hot gases or sparks from an internal explosion but need not be so tight as to seal out flammable atmospheres.

Explosions can be enclosed within walls of sufficient strength to withstand the force if hot gases are permitted to escape gradually and cool as they are vented. Certain restrictions as to widths and clearances must be observed. A small switch box with a cover might have a flat joint width of only 3/8 in. yet must not allow a .0015 in. feeler gauge to enter more than 1/8 in. Greater clearances may be permitted in wider joints. See left hand sketch below.

Screw threads provide excellent flame resistant joints with their five full threads. The right hand sketch below indicates how well threads dissipate heated gases or flames.

Cylindrical shaft bearings must be at least 1 in. in length with a maximum total clearance of .0013 in. With greater lengths additional clearance is permitted. Oscillating shafts may use screw threads as bearings.

Flat surfaces at joints are both inexpensive and effective. However, they are easily damaged by rough handling, or foreign matter may adhere. In such cases, the danger of flame escaping prevails and may render an expensive installation useless. With damaged threaded joints, the mechanic is made aware and may take corrective measures during the installation.

## Operating Temperatures

The Underwriters Laboratories, Inc., have established standards of safe temperature limits for explosion proof enclosures as 180 C (356 F) for ethyl ether or cyclo-propane in Group C; and 275 C (527 F) for gasoline, alcohol, lacquer, solvents in Group D. They are important for explosion proof enclosures for transformers, resistors, rheostats and lighting devices.

Heat can be dissipated by ribs in the metal for increased radiating surface or by fans attached to the shafts. In some cases it may prove economical to install heat generating equipment in an adjacent room, out of the explosive atmosphere.

## Lighting Fixtures

Glass is quite vulnerable to explosion pressures, but must withstand 70 psi or a test pressure of 280 psi. Explosion pressure in the wiring compartment of 200 w fixture will average 145 psi and is designed for 580 psi hydrostatic test pressure. The 280 psi value for glass is quite critical. There is also the problem of sealing the glass to metal surfaces. Area inside of a 150 w globe is approximately 16 sq in., and this multiplied by 280 psi is almost 4500 lb, sufficient to blow the globe out of the holder.

## Temperature Problems

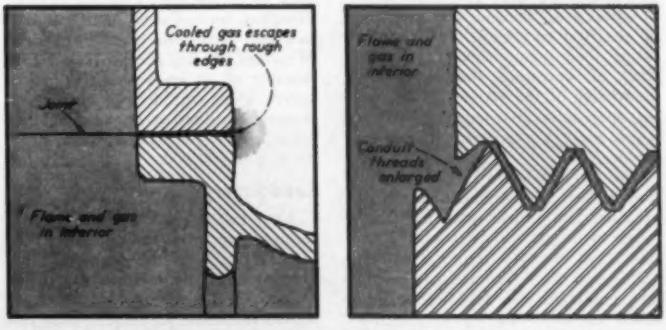
The hot spot on a 300 w non-enclosed lamp is about 150 C at ordinary room temperature. This is an important point since a lamp must operate below 180 C for ethyl ether atmospheres; below 276 C for gasoline.

Dissipation of heat from enclosures on industrial power equipment is not a major problem in itself but the explosion hazard must be considered. Pressures are abnormally high and are influenced by interior volume and shape of casting and degree of gas turbulence developed by an explosion. In a panel board design, all three influences are important. Compartmentation is used to seal off each circuit breaker from others and from the terminal or wire compartments. It also eliminates need for sealing in branch circuit conduits, unless they are over 2 in. in size.

The Code defines the requirements to be met in that classification where air may become flammable through accidental or casual admixture with dusts or vapors. In reviewing building plans it may be difficult to determine in which classification an area should fall. Erring on the side of safety is recommended where possible doubt exists.

Division 2 installations must be of two types, (1) rigid metal conduit, or (2) electrical metallic tubing. As before advocated, seals in conduit runs must also be used here adjacent to all arcing devices. Threaded conduit is required between this seal and the case of the arcing device, even though permitted elsewhere in the installation.

Explosion proof switches and circuit breakers, as in Division I, are required, unless they have oil immersed or hermetically sealed arcing devices. Exception is made for fuses and circuit breakers serving permanently installed incandescent lamps. Class I equipment does not always suit Division 2 installations because of the heat hazard in the latter case. An explosion proof lighting fixture for example could readily run too hot.


Cooled gas escapes through rough edges
Joint
Flame and gas in interior
Flame and gas in interior
Conduit threads enlarged

***Joints for explosion proof enclosures are not usually gas tight, but act as vents to release explosion products slowly, cooling them below the ignition temperature***

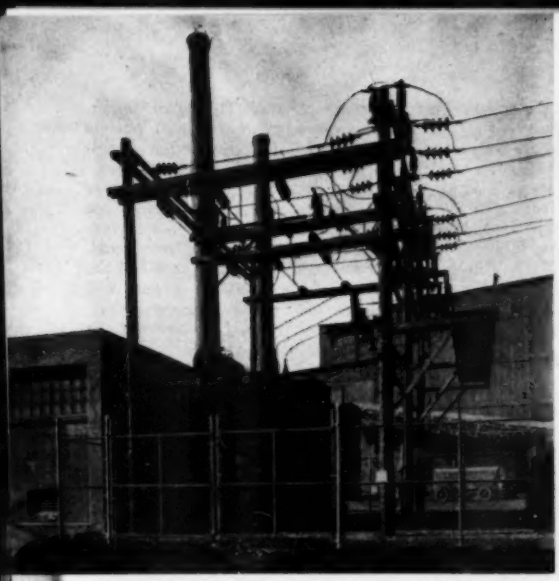


*Fig. 1—A good distribution system starts with an adequate supply and well designed main substation. Duplicate feeders and transformers allow either to carry load in emergencies*

*Fig. 2—Much of the power is used for large, low speed synchronous motors supplied directly at distribution voltages through an underground system designed for easy servicing*

# POWER DISTRIBUTION FOR LARGE MOTORS AT PROSPECT HILL

**Many large motors that must run continuously were among problems to be answered in the selection of the electrical distribution system for a modernized cement plant still planning on expansion**

**A. A. KASPAR, *Chief Electrical Engineer, Guarantee Electrical Company***

GOOD engineering and design for electrical systems is based upon essential information pertaining to: (a) connected load, (b) load factor, (c) peak load demand, (d) efficiency of electrical equipment, (e) expected future load requirement, (f) knowledge of operating conditions, (g) knowledge of the various manufacturing operations, (h) sequence of operations and (i) importance of continuity of service.

The design should provide for the proper electrical equipment, correct application and ample space for installation so that it will be readily accessible. Cost of good design is initially higher, but the difference may be offset many times over by lower maintenance cost and fewer service interruptions. Since the plant discussed here requires a continuous 24 hr, 7 day week operation, need of good design is apparent.

Modernization of the Prospect Hill plant of the Missouri Portland Cement Company, located at St. Louis, resulted in a total production of 14,400 barrels of cement per day and provides a fine example of an up-to-date distribution system where considerable amounts of power are utilized at primary voltages. Total cost of the modernization project was $8,000,000.

## Load Survey

Approximately 12,000 kva of transformer capacity was indicated by a preliminary study of the connected and demand loads. An increase of approximately 33 per cent in load was considered sufficient for contemplated future expansion. Specifications for the transformers were so written as to incorporate provisions for forced air fans to be installed at a later date. This will provide the 33 per cent increase in transformer capacity for future expansion.

In this installation, it was necessary to compare the cost of the 2400 v and 4160 v systems. Utilization of the existing large 2400 v motors and connection of the 2400 v existing system of No. 2 plant to the new installation upon completion date were contemplated. Rewiring of existing motors and motor controls for 4160 v distribution was prohibitive. The 2400 v system became most practical considering the cost.

Union Electric Company furnished double 34 kv primary current from Baden substations, which connected directly to the Venice power plant. The utility engineers based the primary

line short circuit fault capacity at 250,000 kva. Three 4,000 kva, single phase, 34 kv primary, 2400 v secondary transformers in a bank were considered. With this arrangement, the 2400 v system would have a maximum 3 phase symmetrical short-circuit capacity approximating 128,000 kva, and would require switchgear for the feeder circuits having an interrupting capacity of 150,000 kva.

Cost of 150,000 kva I. C. switchgear is greater than that having a short-circuit interrupting rating of 100,000 kva. Therefore, two 3 phase transformers, each normally rated 6000 kva, with an ultimate of 8000 kva to be obtained with cooling fans, were used. The load was equally divided between the two 3 phase transformers whose secondaries were connected to their respective switchgear. This arrangement reduced the required interrupting capacity to 98,000 kva, permitting use of 100,000 kva I.C. switchgear at considerably lower cost.

## Main 2400 v Substation

The 2400 v metal clad switchgear consists of two sections installed indoors, face to face, with a 10 ft passageway between. This provides a generous space for withdrawal of the air circuit breaker to the test position or for complete removal for replacement.

Each section was connected to the throat of the outdoor transformer by means of a 2000 amp, 100,000 kva I. C. outdoor bus duct. Each section consists of a metering compartment for the utility, a 2000 amp main air circuit breaker compartment, 1200 amp bus tie, with key interlock, connected by means of a 1200 amp indoor bus duct from section *A* to section *B* and four feeder compartments rated 600 and 1200 amp.

A bank of 60 cell storage batteries, rated 80 amp for 8 hr discharge at 125 v was furnished, along with a complete fan cooled copper oxide rectifier equipped with charging control. These batteries are used for closing and tripping the air circuit breaker, as well as for emergency lighting in the substation. An automatic contactor will connect the emergency lights to the batteries in event of a-c power failure.

## Unit Substation

There are five 750 kva unit substations with 3 phase, 2400 v primary, 480 v secondary, 60 c, askarel transformers, which have junction boxes with potheads on the primaries and throat connected secondaries. These substations were located as close as physically possible to the load centers of the particular areas they serve.

All five transformers have identical specifications. Primary sides of the transformers were energized from a manually operated load break oil switch, rated 400 amp, 3 phase, 4 kv. This type of switch materially reduced the time required to restore service by isolating the circuits in case of trouble. The oil switches were also used throughout the 2400 v under-

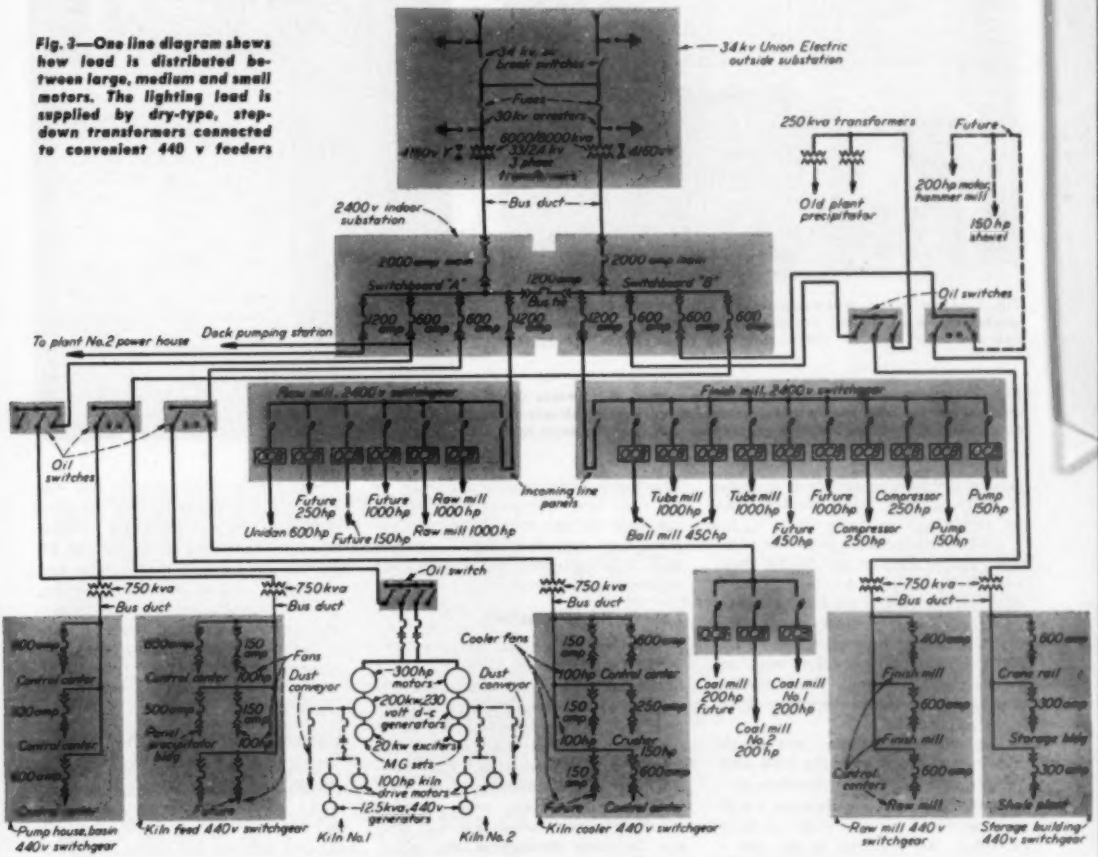



***Fig. 3*—One line diagram shows how load is distributed between large, medium and small motors. The lighting load is supplied by dry-type, step-down transformers connected to convenient 440 v feeders**

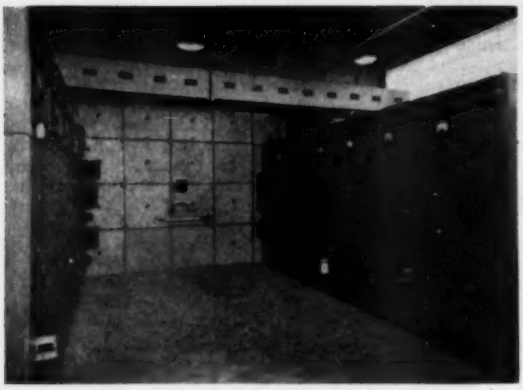


*Fig. 4—The two sections of main substation switchgear are joined together and to outdoor transformers, Fig. 1, by runs of bus duct*

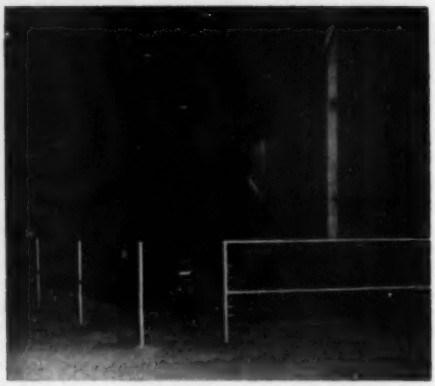


*Fig. 5—High voltage motor starters are mounted over tunnels. M-g sets supply d-c for excitation, inching*

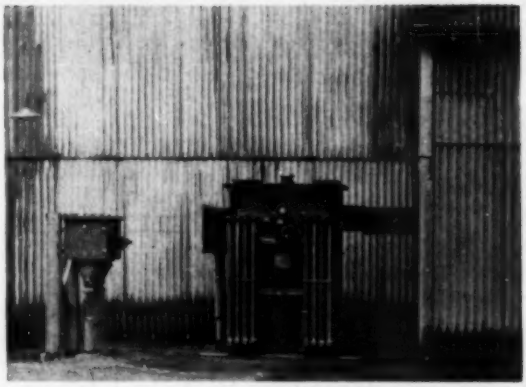


*Fig. 6—Load center transformers are also located outdoors. The separately mounted oil switches each connect two substations and are also used at other switching locations in the system*

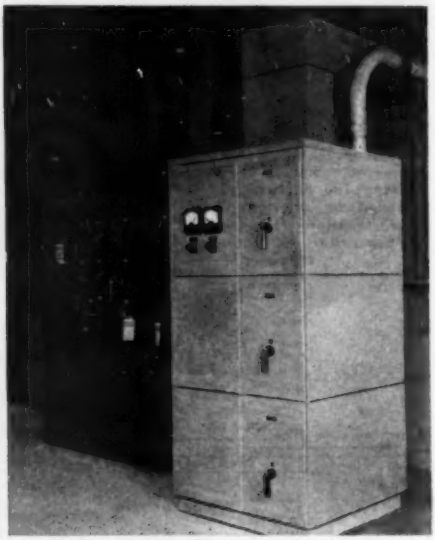


*Fig. 7 (right)—Low voltage breakers are used as starters for medium motors, also supply motor control centers for small motors as necessary. This combination switchgear unit is in the finish mill*

ground distribution system as a means of sectionalizing cable troubles and for switching.

2400 v feeders throughout the plant were standardized at 400 MCM, three wire, V. C. L. C., 5 kv, cable. Feeder circuits originated at the 2400 v indoor substation at the main metal clad switchboard and were protected by the 600 amp air circuit breakers with an overload relay setting. These feeders terminated at their respective load break oil switches.

The 480 v switchgear was in all cases located indoors and the 1000 amp connecting bus duct was therefore partially outdoors, passing through a wall opening sealed to prevent the entrance of water. All breakers in the 480 v switchgear were connected directly to the main bus. The air circuit breakers are draw-out type with 25,000 kva interrupting capacity. Each switchgear unit was equipped with indicating voltmeter and ammeter.

## Low Voltage Starting

Low voltage circuit breakers were used as motor starters for 100 and 150 hp motors. They are electrically operated with trip-free, dual thermal-magnetic overcurrent trips. Undervoltage trips were installed to allow using the breakers as starters, with remote control push button operation.

Control centers also were provided for the groups of small motors at various locations throughout the plant. Power supply comes from the low voltage 480 v switchgear. All interlock control wiring can be easily incorporated in the control center without additional conduit and wire installations.

Control centers are self standing, and have ample control wiring troughs and terminal blocks for controls. The main bus bar section of the center was designed to permit a 25 per cent increase in current carrying capacity for future expansion.

## Underground Distribution

Underground power and control circuits were carried in 4 in. fiber duct banks encased in concrete. Manholes and handholes were provided for pulling and splicing individual lengths of

cable. Spare ducts allow for future expansion of the load, and in some cases, equalled the number of occupied ducts.

Ground rods were driven in manholes before the forms for the roof were placed so as to insure sufficient penetration into the ground. Attempts to drive a rod after the roof is poured results in a short, ineffective rod.

### Grounding System

A ground bus consisting of ¼ x 1 in. flat copper strips was installed between ducts at each bank entrance and exit. These copper strips were held away from the wall by means of spacers and interconnected by a copper bar to the driven ground rod, which in turn was connected to the 4/0 bare stranded copper system ground. The lead sheath of each cable was connected to the ground bus bar.

The ground system consists of 4/0 bare copper cable looped around the entire area of the plant and follows the same route as the underground conduit banks. The ground cable was laid on the bottom of the conduit trench entering each manhole and connected to the ⅝ in. x 20 ft ground rod in the manhole. In addition, separate ground rods are installed at intermediate points.

Fireproofing of cable in the manhole was accomplished by means of two half laps of ¼ x 2 in. asbestos tape and was finished off with an application of silicate of soda, which hardened and kept the tape in place.

### Large 2400 v Motors

The raw and finish mill 2400 v synchronous motor controllers are located in the raw mill part of the building. The controllers are installed in a continuous row and divided into separate groups for each mill—group *A* for the raw mill section and group *B* for the finish mill section. Each bus section is rated 2000 amp, with a 2000 amp sectionalizing disconnect switch.

Power is carried by six, single conductor, 1000 MCM, 5000 v cables through the underground system from the 1200 amp 100,000 kva interrupting capacity air circuit breaker at the 2400 v indoor substation.

Group *A* raw mill section consists of two 1,000 hp synchronous motor controllers and one 600 hp synchronous mill control. Provisions for future expansion include one 1000 hp, one 250 hp and one 150 hp controller.

Group *B* finish mill section consists of controllers for two 1000 hp synchronous tube mill motors, two 540 hp synchronous ball mill motors, two 250 hp compressor motors and two 150 hp pump motors. Provisions were made for future expansion with one 1000 hp and one 450 hp controller.

Controllers have a d-c excitation bus for synchronous motors and a d-c inching bus for large motors. Inching is essential in bringing the mills to a stop at the desired location for inspection and repairs.

D-c current is furnished by two 75 kw, 125 hp m-g sets, with provisions for one additional 75 kw set for future expansion. One unit is capable of furnishing the required load for excitation of the synchronous motors and inching. The second set was so designed that both generators can be paralleled.

The 2400 v motor controllers were furnished with additional remote control push buttons and were installed directly over the cable tunnel. This tunnel is part of the underground system, designed especially to provide ample room for distribution of motor cable leads and to facilitate cable pulling operations.

The raw mill and finish mill operator has complete control of the mills at his disposal without leaving the control desk. They are bench type units with start and stop pistol grip type control switches, indicating lights, speed indicators, level controls, level alarms, selector switches, etc. The sequence of operation employs a very complicated interlocking arrangement, controlling amount of raw material through weighing type feeders, elevators, and pumps, with interlocks between ball mill and compressor pumps.

### Kiln Department

The kilns consist of kiln cooler building, kiln feed end building, two kilns, blending basin, blending tanks and precipitators. They are of outdoor type construction, 450 ft long and 11 ft 3 in. in diameter, supported by seven concrete piers.

The kiln drive is located at No. 4 pier and consists of two 100 hp d-c 250 v motors. D-c power is supplied by one 200 kw generator direct connected to a 300 hp, 2400 v motor. One m-g set with necessary metal clad controllers was assigned to each of the kilns and is located in a concrete vault which is a part of No. 4 pier.

Kiln controls, located in the kiln cooler building have a separate control board for each. This is similar to the power house boiler room combustion control board, is self-standing, metal enclosed with access doors. The operator has complete control of kilns and related auxiliaries.

Control boards are equipped with necessary indicating and recording instruments such as cooler fan, indicating ammeter, cooler speed indicator, cooler-air flow and under-grate pressure, slurry flow, slurry flow counter, kiln speed recorder, indicating ammeter, kiln speed control, kiln jog, m-g set control, waste gas temperature recorder, coal mill temperature control, draft fan control, and the like.

Provisions for the future third kiln were made with necessary conduit for feeder and control circuits.

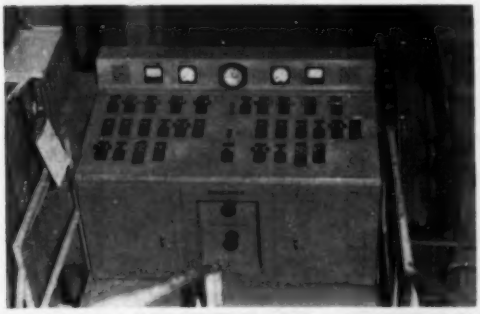
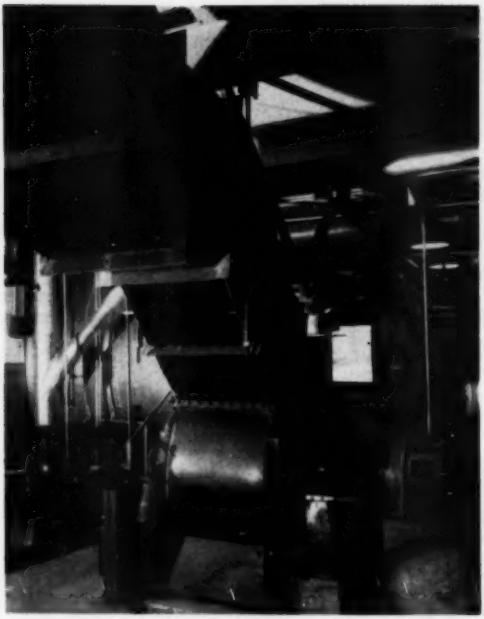


***Fig. 8—Finish mill remote control desk is connected for sequence interlocking, and is raised for better visibility. Controlled operations include material weighing and feed***

**MANUFACTURERS OF MAJOR ELECTRICAL EQUIPMENT**

| | |
|---|---|
| Power transformers | Wagner Electric Corp. |
| Unit substation transformers | Wagner Electric Corp. |
| Switchgear, 2400 v | I-T-E Circuit Breaker Co. |
| Low voltage switchgear | I-T-E Circuit Breaker Co. |
| Control centers | Federal Electric Products Co. |
| Lighting transformers, dry type | Sorgel Electric Co. |
| Load break oil switches | G & W Electric Specialty Co. |
| Large synchronous motors and controllers | Electric Machinery Mfg. Co. |
| Unidan mill controller | Westinghouse Electric Corp. |
| Kiln drive and m-g sets | Westinghouse Electric Corp. |
| Control desks for raw and finish mills | Westinghouse Electric Corp. |
| Feed-O-Weight controls | Westinghouse Electric Corp. |
| Kiln control | Bailey Meter Co. |
| Individual combination starters | Allen-Bradley Co. |
| Cables and wire | Okonite Co. |
| Storage batteries | The Electric Storage Battery Co. |
| Rectifiers | The Electric Storage Battery Co. |
| Telephone | Automatic Electric Co. |

The Fruin-Colnon Contracting Co. of St. Louis was the general contractor



*Forced draft fan with inlet vanes and cinder return blower are located on ground floor under the boiler*

# QUAKER DESIGNS PLANT FOR EASE OF OPERATION

**Two men per shift operate Quaker Oats' new Pekin power plant. The by-product power, produced on an extraction-condensing cycle that furnishes 45 psi process steam, combines with 82.5 per cent average boiler efficiency to provide low cost service for manufacturing operations**

**WALTER H. PROESCHOLDT**
***Assistant Chief Engineer, The Quaker Oats Co.***

THE QUAKER OATS CO. has installed a complete new power plant at their Pekin, Ill. paper mill designed to operate with the minimum of personnel. Installation of this plant was necessary to provide a desired 50 per cent production increase of cardboard employed for packaging finished products. The improved efficiency of the new system will insure a substantial return on the investment and guarantee better service continuity.

This plant operates completely on a unit basis. There is only one paper machine, and any equipment outage causes a shutdown. This unitary principle was followed in design of the power plant and provisions were made for one boiler and one turbine generator. Great care was taken to provide conservatively designed components to insure maximum equipment availability and minimize down-time.

Initial studies led to a rearrangement of process steam and power services. A steam engine previously employed to drive the paper machine was removed and replaced with motors. Constant speed points are equipped with standard a-c motors while the main drive, which requires speed control, employs a shunt-wound d-c motor. Necessary conversion for supplying this service is accomplished by a motor-generator set.

Steam requirements for plant processes and heating were estimated at 32,000 lb per hr. Normal electrical load approximates 1000 kw and this includes the power plant auxiliaries. Since the load is essentially constant whenever the paper machine operates, the system contemplated did not include any steam line with desuperheating station for direct plant supply. This means total boiler output passes through the turbine.

Formerly, this plant operated with two old straight tube sectional header boilers with longitudinal drums. All steam was generated at 125 psi saturated, and total capacity was required continuously. The turbine generator utilized steam at this pressure and produced a maximum of 500 kw on a straight condensing cycle. Balance of steam employed in process work and for heating was reduced to 45 psi before distribution through the mill. Boiler efficiency averaged under 60 per cent, which is typical of an old installation of this type. Steam required by the turbine was over 40 lb per kw hr produced, and thermal efficiency was under 10 per cent. In addition, full time services of approximately 15 men were needed for continuous operation.

Basic considerations in design of the new system were: (1) reduction in operating personnel, (2) improved operating efficiency and (3) continuous availability. Modern equipment conservatively designed was expected to achieve the desired efficiency with the minimum maintenance. Personnel reduction was to be accomplished by centralizing boiler, turbine and fully automatic controls in the same area and providing adequate coal and ash handling equipment.

Adequate space was not available in the existing boiler house for the system contemplated. An entirely new concrete block building with brick exterior and steel structurals throughout was erected. Steel stairways and ample platforms were provided to allow excellent access to all plant equipment.

## Turbine Design

Turbine design was established first to obtain the necessary heat balance. The unit selected is rated at 1875 kva and produces 1500 kw of 480 v, 3-phase, 60 cycle a-c current at 0.8 power factor. This size will permit additional plant production, present normal load being 1000 kw. The turbine is designed for direct drive at 3600 rpm, with no gear reduction required. A direct connected 16 kw, 125 v d-c exciter is mounted on the outboard end of the generator shaft.

Steam conditions at the throttle are 400 psi and 600 F TT. Operating cycle

is single extraction-condensing, with provision for manual presetting of extraction pressure for a range of 20 to 50 psi. Normal operation is at 45 psi extraction pressure, which is identical with previous conditions and did not require any process piping changes. Turbine back pressure will vary from slightly under 1 to 2 in. Hg at maximum load.

These design conditions dictated the use of 600 psi pipe and fittings in the boiler plant. All welded construction was employed with flanged connections at the necessary cast steel valves.

Well water with an average temperature of 56 F supplies all plant processes including boiler feed and condenser cooling. For this latter service, a two pass surface type condenser is employed with sufficient capacity to enable operation of the turbine generator on a full condensing cycle at maximum rating. Well water circulated through this condenser at a constant rate of 700 gpm is discharged to paper mill process work and provides a once-through system. No condensing water treatment has been found necessary, other than spot chlorine feeding to eliminate occasional odors.

After turbine requirements were established, design of the necessary boiler was started. A bent-tube four-drum boiler of suspended construction with fully water cooled furnace, designed for 450 psi, was selected to provide 410 psi-600 F TT steam at the pendant type superheater outlet. Gases flow vertically over all heating surfaces, including an economizer located at rear of boiler. Rated output is 40,000 lb per hr continuous with provision for maximum loads of 46,000 lb per hr for short periods. This insures an ample margin of safety as present loading of boiler approximates 32,000 lb of steam per hr.

When the boiler was purchased only pressure parts were obtained from the manufacturer, and all auxiliary equipment, including the necessary setting, was handled by separate contract. A setting that employs tile in the furnace covered by block insulation and insulating cement on metal lath was selected. Baffles are tile and castable refractory throughout, and adequate provision for expansion of pressure parts is included. All walls are supported by studs welded to water wall and boiler tubes. Support for the baffling is also furnished by the tube structure where necessary.

Low conduction losses and a high degree of air-tightness have been provided by this setting. Simultaneous Orsat analyses between the first tube bank and the boiler outlet indicate a drop of less than 0.2 per cent $CO_2$ in the dry products by volume through the convection bank.

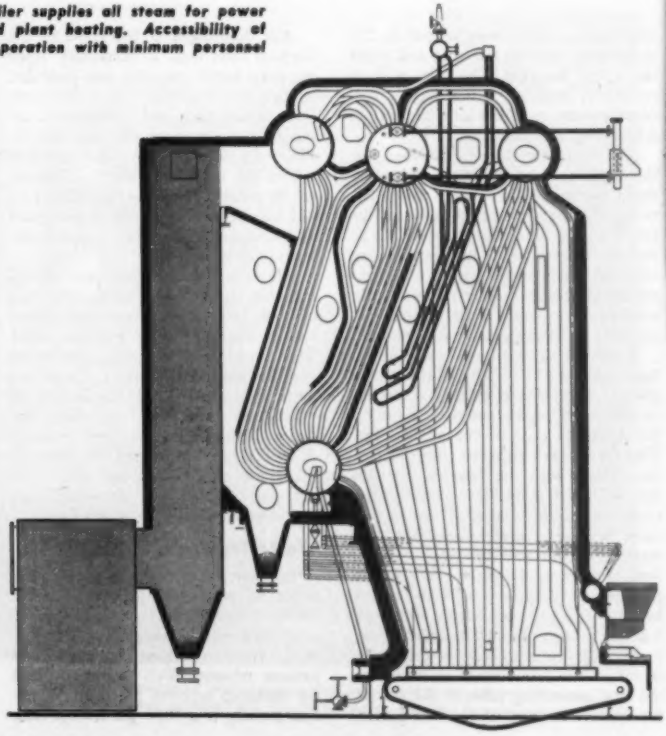
Low grade Illinois bituminous coal with a heat value of 11,000 to 12,000 Btu per lb is fired at this plant. Deliveries by railroad car are unloaded into a gravity track hopper that feeds coal to a continuous flight conveyer, which supplies a 300 ton tile storage silo. When the silo is filled, additional coal flows outdoors through an overflow chute to a yard storage area where 2000 tons are maintained as a reserve.

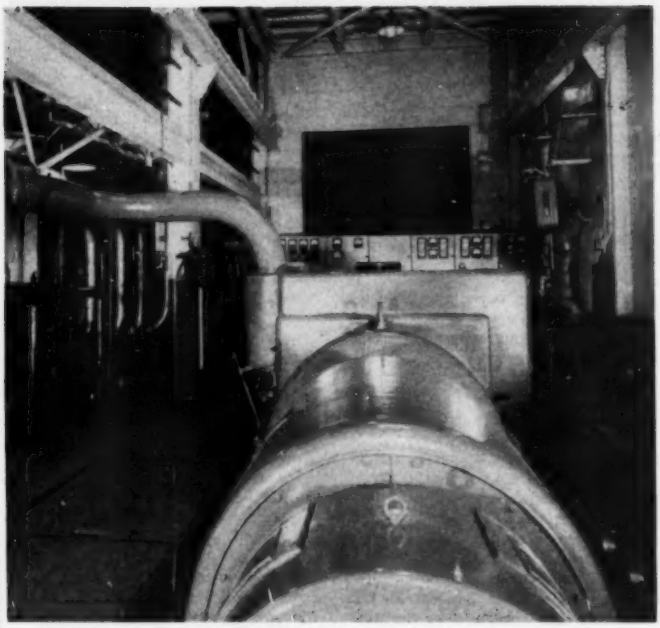
A tractor mounted coal loader transports coal to and from storage. Bulldozing of the pile after distribution serves to compact the coal and minimize fire hazard. When reclaiming stored coal, the loader feeds a yard hopper, which serves the same conveying system. Repeated coal handling on the storage pile is held to an absolute minimum with this arrangement.

Coal passes continuously from the live storage shelf in the silo to the boiler room through a chute. An auto-

***One spreader stoker fired boiler supplies all steam for power generation, process work and plant heating. Accessibility of auxiliary equipment permits operation with minimum personnel***

***A tubular dust collector mounted on the operating floor removes fly ash from gases leaving the economizer. The induced draft fan inlet dampers provide control of furnace pressure***





*Turbine generator, boiler, power distribution panel and combustion control board are consolidated on the operating floor of the plant*

matic scale, which weighs coal in 200 lb batches, receives the coal and feeds the stoker hoppers. The silo will, if necessary, store an entire week's fuel requirement, and this aids greatly in scheduling shipments.

The spreader stoker furnished for this boiler is a 2-feeder unit with overthrow rotor and traveling grate, ash being discharged continuously at the front of the unit. Exceptionally large furnace volume and moderate firing rates prevent slag formations and permit maximum continuity of service. In addition an overfire air system was supplied to assure good combustion.

Although there are no smoke abatement restrictions in the vicinity of the plant, a tubular type dust collector was provided for separation of fly ash on the discharge side of the economizer. This fly ash is reinjected into the furnace along with the heavier particles that settle out in the last pass and the economizer. Cleanliness of boiler surfaces has been excellent, as full coverage of all surfaces by steam actuated soot blowers operating at full boiler pressure is employed. There are 4 heads in the generating tube bank and 3 heads in the economizer. In addition, a gun type volume blower set in the center of the front water wall sweeps the first generating tubes at the rear of the furnace in front of the first baffle.

Ash discharged at the front of the furnace falls into a refractory lined hopper. Ample capacity was provided so that ash removal is necessary only once during each shift. Disposal is accomplished hydraulically, the hopper feeding a sluicing system that transfers ash to the outside of the building, at which point it is utilized for filling an old lake bed. This system is energized and attended by one man unless maintenance is required.

All boiler house auxiliary equipment is motor driven with exception of one centrifugal feedwater pump that is equipped with turbine drive. There are two feed pumps, one steam and one electrically driven. These two units represent the only duplication of equipment employed throughout the entire system. Forced and induced draft fans are connected to constant speed a-c motors. Volume control is obtained by inlet vanes on the FD fan and inlet dampers on the ID fan.

## Water Treatment

As previously mentioned, well water is employed for boiler feed. Make-up averages 11 per cent of the total feed, the balance being returned in the form of turbine condensate and process returns. Well water utilized for make-up receives pretreatment before passing to a 5000 gal storage tank in the boiler house. This treatment is necessary as the water hardness approximates 27 gr as $CaCO_3$. Sodium zeolite and hydrogen zeolite are employed in combination to reduce water to zero hardness. This softening system is also on a unit basis, and during regeneration supply is maintained from the 5000 gal storage tank.

Soft water is transferred from the storage tank through a film type feedwater heater. Condensate and makeup water flow into a water pan and the mixture directed over suspended metal rods. Vertical water flow on these rods remains constant at all times, and the exhaust steam, which enters heater at the top, must pass between them before entering a storage chamber. Deaerating is accomplished in a secondary vent condenser, which employs a back pressure of 5 psi and recovers heat in the vented vapor and non-condensable gases. Final temperature leaving heater is 225 F.

Suction side of boiler feed pumps is connected to the feedwater heater, and water passes through the economizer before entering boiler drums. Exit temperature leaving economizer approximates 350 F. Since the boiler operates continuously under all load conditions, the economizer was conservatively designed to prevent possibility of cold end corrosion under light load conditions.

Secondary feedwater treatment, consisting of continuous feeding of phosfate and neutralizing solution, has been provided. Chemicals are introduced on the suction side of the feedwater pumps. Boiler water samples are analyzed and the pH of the returns measured to determine the amount of treatment required and the rate of blowdown. Flashed steam from the blowdown tank is returned to the feedwater heater. Although the boiler is normally out of service only two weeks per year, there has been no necessity of cleaning the internal surfaces since initial operation was started.

Complete combustion control, providing fully automatic or manual operation of boiler, has been furnished. System is air actuated and designed to maintain constant steam pressure. Changes in pressure cause an unbalanced condition in the master control, which calls for an increase or decrease in firing rate. The fuel feed controller responds and adjusts the stoker speed. An interlock between fuel feed and primary combustion air flow controller results in adjustment of the forced draft fan inlet vanes to meet required air condition.

Furnace draft is maintained at minus 0.12 in. wg by means of a balanced draft control, which positions the induced draft fan inlet dampers.

This system has provided excellent combustion and resulted in an average efficiency of 82 to 82.5 per cent. Periodic observations indicate $CO_2$ to be approximately 14 per cent. Based on this performance, fuel cost per 1000 lb of steam produced averaged 32 cents during 1951, total coal cost being $5.32 per ton delivered.

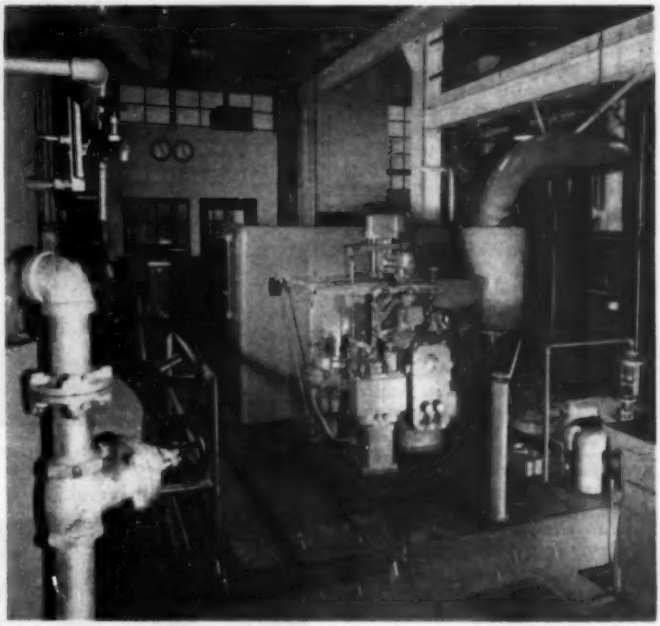
When this steam cost is combined with the fact that normal operation of the turbine provides essentially by-product power, it is obvious that great savings have been effected. At normal loading of approximately 1000 kw with average process demand, only slightly more steam is condensed than the minimum required by design. On several occasions the turbine generator has been operated to produce power only for boiler house auxiliaries and some plant lighting when process steam demand was approximately 8000 to 10,000 lb per hr. Even at this low rating, the steam rate is less than one third the rate of the previous unit.

Records of results are obtained through instrumentation that has been provided. A steam-flow air-flow recorder gives a continuous qualitative analysis of combustion conditions and indicates any irregularity in performance. Additional recorders provide data on the following items: (1) steam pressure, (2) feedwater pressure, (3) steam temperature, (4) feedwater temperature entering economizer, (5) feedwater temperature leaving economizer, (6) flue gas temperature leaving boiler and (7) flue gas temperature leaving economizer. An indicating gage showing steam pressure and an eight-point draft gage for various points in the air-gas passes have been furnished.

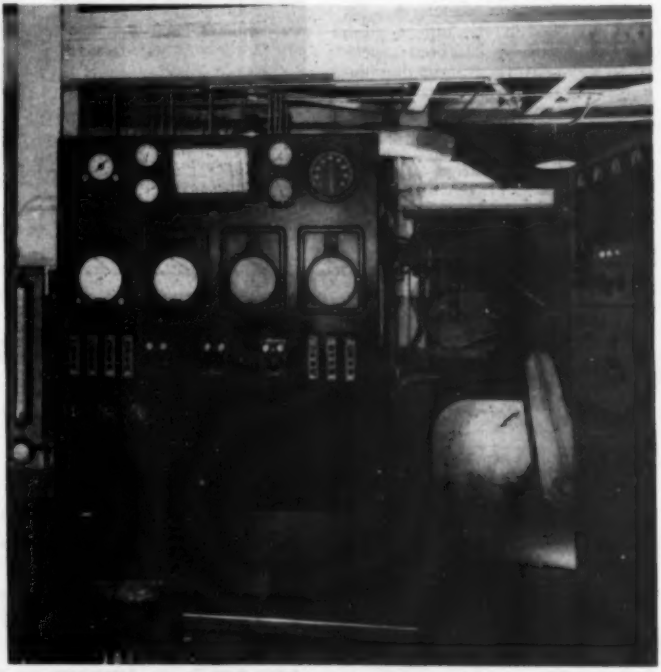
One important feature of the control equipment is the combination water level controller-recorder. Records of water level limits maintained for all conditions of load are invaluable, particularly when operation is continuous. In addition, the water column and eye level water gage provide two other positive indications of this fundamental detail.

### Operating Personnel

With this arrangement of control and auxiliaries, the plant now operates with a full time complement of seven men. One operator and one helper per shift working a six day week handle all functions in the combination boiler-turbine room with the odd man relieving all of the others on their day off. The helpers unload coal, discharge ashes, regenerate the softeners, test feedwater and perform routine utility work. In emergencies, if additional labor is required, it is drawn



***Minor cycle variations are compensated manually by synchronizing a clock on the plant circuit with one connected to the utility line***



***Complete records of performance, achieved by the air operated combustion control system, are furnished by the boiler instrumentation***

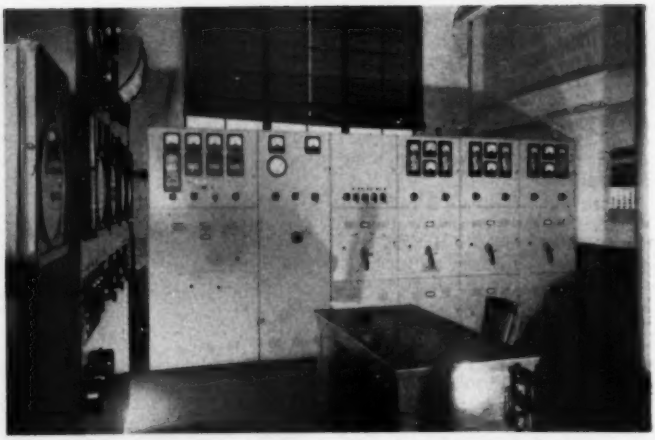
from plant personnel. Maintenance is normally handled in similar fashion except during shutdowns when boiler plant personnel do the repair work.

At the present time, the old boilers and condensing type turbine are being removed from this plant. This means the new boiler and turbine operating as a unit provide the only available source of service. To overcome complications that might arise in the event of a shutdown, an electrical power tie from the local utility company is maintained that affords 50 kw service. This enables operators to start the boiler and bring it up to normal operating pressure.

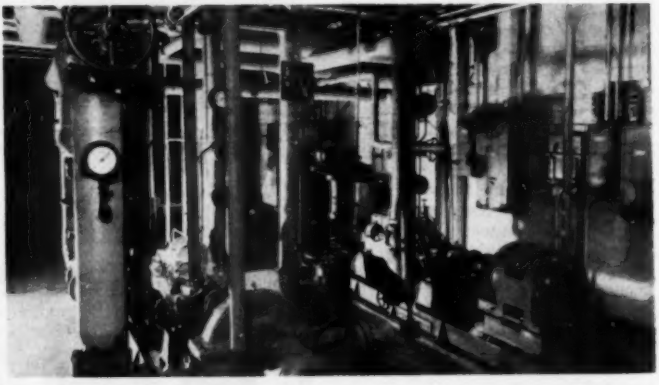
During normal operation with all power produced by the one generator, cycle variations could occur. Accurate control of this detail is obtained through a system, which employs two clocks. One clock connects to the utility company line while the other runs on the plant's generator. Manual regulation of turbine speed when necessary to synchronize the two clocks insures positive cycle control.

While starting up, extreme care is taken to evaporate all water from the pendant superheater and steam lines before opening the throttle valve on the turbine. This is important as there is no by-pass line to process mains and all steam produced passes through the turbine. Although a separator has not been furnished in the turbine steam line, no difficulty has been experienced with carryover as steam drum internals have insured dry quality steam to the pendant superheater.

With the arrangement described, vast savings in power production have been achieved. Productive capacity is increased over 50 per cent and further expansion would be possible with the equipment as designed.



***Overload protection is incorporated in metal enclosed switchgear. Meters for each circuit provide accurate data on load distribution***



***Dual feedwater pumps, one steam and one electric, constitute the only duplicate equipment furnished for the complete power system***

**PRINCIPAL EQUIPMENT IN THE POWER PLANT**

| | |
|---|---|
| Turbine generator | General Electric Co. |
| Switchgear and electric meters | General Electric Co. |
| Condenser, condensate pump and motor | Allis-Chalmers Mfg. Co. |
| Vacuum pump | The Nash Engineering Co. |
| Vacuum pump motor | General Electric Co. |
| Boiler pressure parts | The Babcock & Wilcox Co. |
| Superheater | The Babcock & Wilcox Co. |
| Economizer | The Babcock & Wilcox Co. |
| Boiler setting | Nels E. Werner Co. |
| Soot blowers | The Bayer Co. |
| Spreader stoker | Detroit Stoker Co. |
| Feeder drive | Reeves Pulley Co. |
| Feeder drive motor | The Louis Allis Co. |
| Grate drive | Link-Belt Co. |
| Grate drive motor | General Electric Co. |
| Forced draft fan | Clarage Fan Co. |
| Forced draft fan motor | Westinghouse Electric Corp. |
| Induced draft fan | American Blower Corp. |
| Induced draft fan motor | Allis-Chalmers Mfg. Co. |
| Flyash collector | Western Precipitation Corp. |
| Overfire air fan | Clarage Fan Co. |
| Overfire air fan motor | The Louis Allis Co. |
| Flyash return fan | Buffalo Forge Co. |
| Flyash return fan motor | The Louis Allis Co. |
| Flyash reinjection | Detroit Stoker Co. |
| Boiler feed pumps | Ingersoll-Rand Co. |
| Boiler feed pump motor | General Electric Co. |
| Boiler feed pump turbine | General Electric Co. |
| Feedwater heater | Mead, Mulloy Corp. |
| Feedwater regulator and recorder | The Bailey Meter Co. |
| Coal conveyer | Stephens-Adamson Mfg. Co. |
| Coal storage silo | Kalamazoo Tank & Silo Co. |
| Coal scale | Richardson Scale Co. |
| Coal loader | Frank G. Hough Co. |
| Bulldozer | Caterpillar Tractor Co. |
| Ash disposal system | United Conveyor Corp. |
| Combustion control | The Bailey Meter Co. |
| Boiler instrumentation | The Bailey Meter Co. |
| Air compressor | Worthington Pump and Machinery Corp. |
| Air compressor motor | Standard Dayton Corp. |
| Feedwater treatment | Elgin Softener Corp. |
| Chemical pump | Hills-McCanna Co. |
| Chemical pump motor | General Electric Co. |
| Blowdown valves | The Okadee Co. |
| Continuous blowdown valve | Manning, Maxwell & Moore, Inc. |
| Safety valves | Manning, Maxwell & Moore, Inc. |
| Water column | Reliance Gauge Column Co. |
| Remote water level indicator | Reliance Gauge Column Co. |
| Valves | Edward Valves, Inc. |
| Valves | Henry Vogt Machine Co. |

# WHEN TO USE SYNCHRONOUS MOTORS

**That synchronous motors can improve power factor while driving the load is well known. To avoid economically unsound applications, this quick survey of factors shows where synchronous types are profitable and where the induction motors are better**

**G. L. OSCARSON**
***Chief Application Engineer***
***Electric Machinery Mfg. Company***

SYNCHRONOUS motors can be designed with characteristics making them suitable for nearly any constant speed application which can be driven by squirrel cage motors; however, economics and common sense will determine when they should be used. In general, size and number of poles are important factors. Fig. 1 illustrates the speed and horsepower ranges preferred for synchronous and induction motors.

To fit electrical conditions involved, there is usually one best selection of motor type for the application. The purpose of this article is to show where a synchronous motor is the logical choice.

Of first importance is the ability to start and drive the load. Without excessive mechanical shock, undue disturbance to the electrical system or injury to the motor, it must be able to: (a) start the load from rest, taking into account any normal or emergency unloading means; (b) accelerate and pull into step; (c) operate under normal load conditions; (d) withstand normal peak loads for the application; and (e) resynchronize, if desired upon restoration of normal conditions, if the motor drops out of step due to overload or under-voltage.

Synchronous motors must operate at a fixed average speed. Sometimes, mechanical considerations or limited line capacity make it desirable to take advantage of either normal or design-increased flywheel effect in pulling through peak loads. Such cases might be represented by punch press or chipper loads. Obviously, however, where a drop in speed is desired during the peak load period, a high slip squirrel cage motor or a wound rotor motor operating with secondary resistance is indicated.

Where constant speed drives are acceptable, synchronous motor applications vary from attrition mills to wood hogs. Table 1 shows NEMA recommended torque values for some of these applications. However, the fact that a synchronous motor can be designed to handle these loads is not evidence that it should be used in every case.

Table 2 illustrates torque, starting kva, and slip characteristics of medium and large size a-c motors. Note

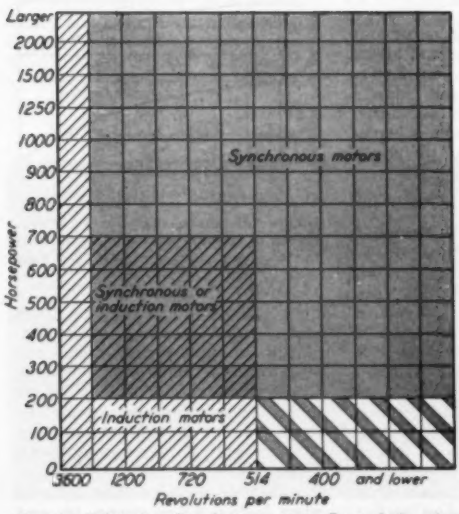
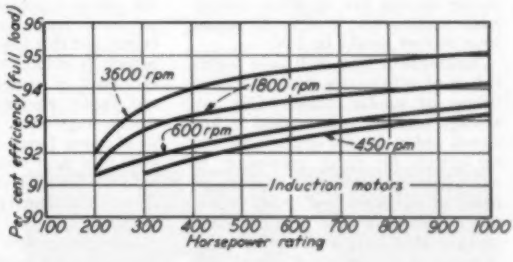



**Fig. 1—Although other factors may affect choice, low speeds and large size favor synchronous motors. On low speed, direct drives, they can eliminate gear reducers**



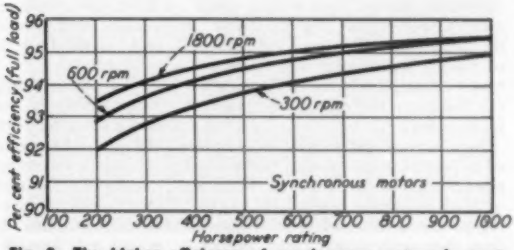




**Fig. 2—The higher efficiency of synchronous motors is most pronounced at the lower speeds. Operating time, power cost and first cost will, however, influence final choice of type**

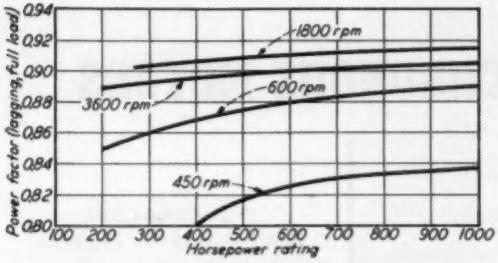



***Fig. 3—Lagging power factor of induction motors, above, and the leading values for synchronous types make them a perfect team in plants where both have good applications such as many small motors and heavy, constant speed loads***

**TABLE 1 — TYPICAL TORQUE RECOMMENDATIONS — PARTIAL LIST FROM NEMA MG1-8.9**

| Application | Torque in per cent of full load: Locked rotor | Pull in | Pull out |
|---|---|---|---|
| Attrition mills, unloaded | 100 | 60 | 175 |
| Ball mills, rock | 150 | 110 | 150 |
| Banbury mixers | 125 | 100 | 250 |
| *Centrifugal blower, valve closed | 40 | 60 | 150 |
| *Centrifugal blower, valve open | 40 | 100 | 150 |
| *Chipper, empty | 60 | 50 | 250 |
| Compressor, reciprocating | 40 | 30 | 150 |
| Grinder, pulp | 50 | 50 | 150 |
| Line shaft, flour mill | 175 | 110 | 150 |
| Centrifugal pump, valve closed | 40 | 60 | 150 |
| Centrifugal pump, valve open | 40 | 100 | 150 |
| Rolling mill, plate | 40 | 30 | 300 |
| *Wood hog | 60 | 100 | 225 |

*High inertia loads. Inertia may determine actual pull-in torque required and motor manufacturer should be advised of its value.

**TABLE 2 — TYPICAL TORQUE, KVA AND SLIP CHARACTERISTICS OF A-C MOTORS**

| Characteristics | Squirrel cage: NEMA B 1800 rpm or less | NEMA B 3600 rpm | NEMA C | NEMA D** | TYPE X* | Synchronous***: 1.0 pf, 500 rpm or above | 1.0 pf, below 500 rpm | 0.8 pf, 500 rpm or above | 0.8 pf, below 500 rpm | Wound rotor** |
|---|---|---|---|---|---|---|---|---|---|---|
| Normal locked rotor torque per cent full load torque | 100-150 | 75 | 225 | 275 | 60 | 85-100 | 40 | 100-125 | 60 | 100-125 |
| Approximate starting kva, per cent full load kva | 500-650 | 500-550 | 450-500 | 400-450 | 430 | 550 | 250 | 550 | 300 | 150 |
| Breakdown torque, per cent full load torque | 200-225 | 200-225 | 225 | 250 | 175 | 150 | 150 | 200-250 | 200-250 | 225 |
| Nominal full load slip, per cent synchronous speed | 2-3 | 1½ | 3-5 | 8-15 | 2 | — | — | — | — | 3 |

*For coupled duty only. For drives which are started unloaded.
**These motors will start and operate high inertia and peak load drives off small electrical systems with minimum disturbance.
***Torques may be increased, with corresponding kva increase, for specific applications.

that the starting kva for squirrel cage motors equivalent to Design B and for synchronous motors are approximately equal for equivalent torques. For high starting torque and moderate or low starting kva, or where controllable acceleration is desired, wound rotor motors should be used.

Synchronous types will have higher full load efficiencies than induction motors of similar rating. This advantage becomes very marked at low speeds and makes the synchronous motor suitable for direct connection to many low speed loads. A study of hours of operation per year, power cost per kilowatt hour, penalties, comparative efficiency, and cost of synchronous versus induction motor will determine the best choice from standpoint of power cost. Fig. 2 illustrates the comparative full load efficiencies of various synchronous and induction motor ratings, while Fig. 3 shows typical induction motor full load power factor values.

Synchronous motors may be designed to operate at either unity or leading power factor. In the latter case, amount of lead is usually controllable. Leading power factor motors are less efficient than unity power factor motors, but they are double-duty motors, providing mechanical power plus a leading reactive kva component for power factor improvement.

Selection of synchronous motors with leading power factor should be thoroughly considered. Whether electric power is generated by the user or purchased from a utility, it is an accepted fact that low power factor costs money. It reduces capacity and lowers efficiency of generating, distribution and feeder equipment and impairs voltage regulation. A complete analysis of power factor correction is impossible in a short article, but the principal rules for alleviation by use of synchronous motors can be stated quite briefly.

Induction motors have low lagging power factor if operated at light loads. Thus, if possible. they should be avoided in applications where they operate much of the time at part load or no load.

The magnetizing component, or lagging reactive kva input, of induction motors does not vary greatly with changes in mechanical load. In general, each horsepower of connected induction motor capacity will require 0.35 to 0.6 reactive kva to magnetize it. On the other hand, synchronous motors will provide a leading reactive kva component as shown in Fig. 4.

Motors applied to loads requiring high pull out torques (above 150 per cent of full load rating) such as Banbury mixers, rubber mill lines, steel mills, hammer mills and chippers, should be leading 0.8 pf design except in cases where excessive leading reactive kva may result. Motors built for 125 per cent or more starting torque should also have leading power factor. Electrical design is more balanced when leading 0.8 pf motors are used in such cases, and cost is usually little if any higher than for unity power

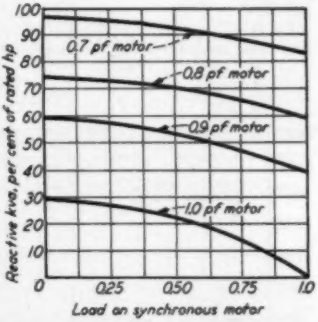



***Fig. 4—The leading reactive kva of synchronous motors varies with the load for a given setting of the d-c field***

factor types having the same torque characteristics.

A few general rules may be established as a guide in motor selection, bearing in mind that specific local conditions must necessarily be considered:

1. Power factor and efficiency of 3600 rpm squirrel cage motors are very good. Complications in mechanical construction and control of two pole synchronous motors weigh heavily against their use.

2. At 1800 rpm, squirrel cage motors are again a logical choice, unless power factor correction is very important.

3. In speeds from 1200 down to 500 rpm inclusive, any motors 700 hp and above should usually be synchronous if for normal operation. From 201 to 700 hp inclusive, the choice might depend upon hours of operation per year, cost per kw, necessity for power factor improvement, etc. Applications up to 200 hp inclusive are usually well taken care of by general purpose squirrel cage motors.

4. Induction motors should rarely be applied in speeds below 500 rpm, due to low power factor and efficiency values. For some standby applications, they may be acceptable. On the other hand synchronous motors can be built at unity or leading power factor and at high efficiency in speeds as low as 72 rpm. For direct connection, below 500 rpm and above 200 hp, to grinders, mixers, rubber mill lines, flour mills and the like, synchronous motors are in a class by themselves and will certainly be first choice. Compressor motors, 100 hp and above, in this speed range should be synchronous. In high torque applications through 200 hp, choice would depend on advantages of power factor improvement, direct drive and efficiency compared to advantages of a high speed induction motor and speed reducer.

Synchronous motors have earned a prominent place in industry and should be seriously considered for heavy, constant speed applications.

# FASTENING HEAVY PARTS BY STUD WELDING

● Often a process developed primarily for production proves to be flexible enough to use for plant installation and maintenance. Stud welding with large studs, now being employed in the manufacture of heavy equipment for steam plants, is an example. It may be used in plant fabricated or erected equipment where covers or other parts cannot be welded permanently. The gun, timing control and a standard arc welding generator comprise the equipment needed.

Fabrication of large units used in steam and power generating stations requires an extensive amount of assembly work in fastening portions of the machinery together to form a finished product. Since many components are large and unwieldy, any method which speeds assembly operations is particularly advantageous—provided the fasteners can withstand the strains and vibrations to which the equipment is subjected.

At the East Chicago plant of Combustion Engineering-Superheater, Inc., end-welded studs have been used on several different coal pulverizer and steam generator components. Studs up to 7/8 in. are end-welded to machine frame members at the rate of 4 or 5 a minute. Much faster than the conventional drilling and tapping, the process lends itself particularly well to the manufacture of heavy equipment fabricated from steel.

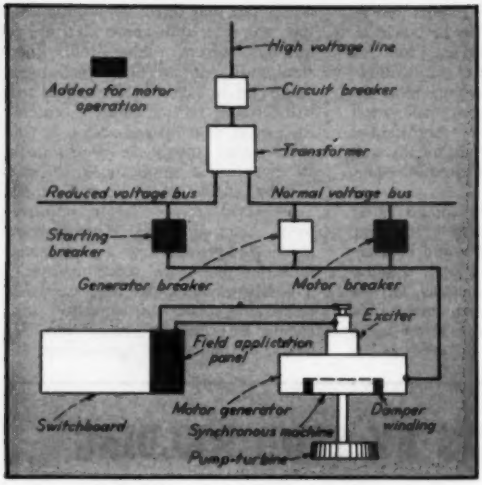
Cover plates for the exhauster casings of coal pulverizers are held in place by as many as 64, 7/8 in. end-welded studs on each side of the casing. Smaller units use 48 on each side. Originally, the casings, which are approximately 1 in. thick, were drilled and tapped. This method of fastening a bolt to a frame member has been replaced by stud welding, with less than 20 sec for each complete weld. It is estimated that the drilling, tapping, and stud setting method requires between 2 and 4 min.

A special locating device illustrated below was developed to assure proper alignment of studs around the casing. It consists of a plate attached to the gun, with two set screws at right angles to the stud. After the operator places the stud and ceramic ferrule in the chuck, he positions the tip of the stud in the center punch mark on the casing, with the two set screws against the inner surface of the casing, and presses the gun's trigger. The locating device provides a tripod arrangement which assures welding the stud square to the work and in a true bolt circle.

*Courtesy Nelson Stud Welding Division, Morton Gregory Corporation*

***Stud welding saves drilling and tapping on many parts that must be bolted together in assembly. It is particularly advantageous on heavy parts hard to handle on a drill press***

***From ¼ to ⅜ in. dia studs are used on large fabricated parts. A simple locating device on gun insures alignment on a 6 ft, 10 in. part. The white ferrules will be removed***




**For hydro-storage, water pumped up to a reservoir during low-demand periods drives a turbine and generates power for peak demands. A synchronous machine can operate either as motor or generator. Recently, hydraulic turbines that operate efficiently as pumps have been developed. This reduces the investment required for equipment, but complicates electrical control. Here are the problems and a simple explanation of the answers**

**WM. L. RINGLAND, *Electrical Engineer***
***Allis-Chalmers Manufacturing Company***

***Fig. 1—Operation of the generator as a motor requires the equipment in black blocks. The starting breaker and low voltage source are used only when starting kva must be low***

# PUMP-TURBINE ELECTRICAL CONTROLS FOR HYDRO-STORAGE

ELECTRICAL EQUIPMENT required for pumped storage hydroelectric plant consists of well-known elements selected to meet an uncommon combination of performance requirements. Compared with a generating station, chief differences arise from the necessity of starting and operating the synchronous machine as a motor with direction of rotation opposite to that required when it operates as a generator. For although the machine could operate as motor or generator in either direction, the pump-turbine requires the two rotations for its functions.

Amount and kind of electrical equipment in the generating plant will vary with circumstances. However, minimum additional features made necessary by motor operation are almost certain to include a suitable damper winding for the synchronous machine, a circuit breaker for reverse rotation, and field application control, Fig. 1. Reduced voltage starting would add a starting breaker and either taps on the main transformer, a separate autotransformer, or reactors. All of this equipment is familiar and would operate in the same manner as for other applications.

Maximum power required during the pumping cycle exceeds maximum power generated by the machine by about 10 per cent. This discrepancy in duty can be handled by rating the synchronous machine at 0.9 pf as a generator and at unity pf as a motor, thus maintaining about the same kva rating for both conditions. This would generally suit system requirements because pumping would occur at night when the system load would require less reactive kva.

Although the pumped storage plant will generally require more electrical equipment, some features usually considered necessary in a generating plant may be eliminated. Since the unit would normally operate at maximum power corresponding to the head available and would do little or no frequency or voltage regulating, need for a voltage regulator and a pilot exciter is questionable. Also, amount of flywheel effect required in the unit might be reduced to normal for the rating because hydraulic regulating would not be critical. The lower overspeed possible with the pump-turbine design may permit a reduction in overspeed requirement to 175 per cent or less.

## Starting Performance

The most serious electrical problem in designing the plant will probably be motor starting. Amount of starting kva permitted on the system is the governing factor and determines equipment and starting procedure used.

Pumps of the type under consideration require only a little less than maximum power at shut-off. Starting under this condition would require approximately 100 per cent pull-in torque and the corresponding full voltage starting kva would be about 500 per cent for a unity pf motor. With reduced voltage starting, maximum kva demand could be limited to about 350 per cent.

Cost considerations, as well as system limitations, would generally favor installation of a compressed air system to permit starting the pump unwatered. Pull-in torque then becomes insignificant, and the limiting requirement is the breakaway torque of the bearings. This would seldom exceed 15 per cent with normal lubrication, Fig. 2. Minimum full voltage starting kva of a motor suitable for these conditions is determined by considerations other than the torques required, and would generally be between 200 and 300 per cent. With reduced voltage, motor starting kva could easily be limited to 100 per cent with normal lubrication, or to less than 50 per cent with a high pressure oil system added to the thrust bearing.

Starting impedance of a synchronous motor is usually about the same as its direct axis transient reactance. That is, a motor with 250 per cent starting kva

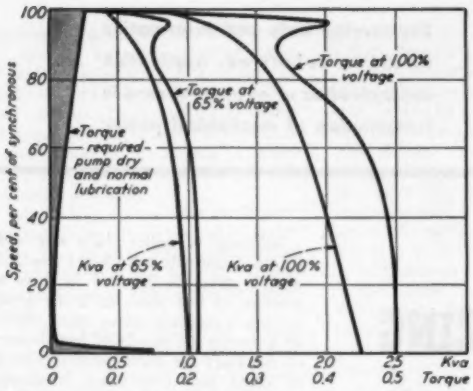



**Fig. 2—Starting performance of a large, low speed synchronous motor on a vertical pump shows fractional values of starting torque and kva compared to dry pump requirements**

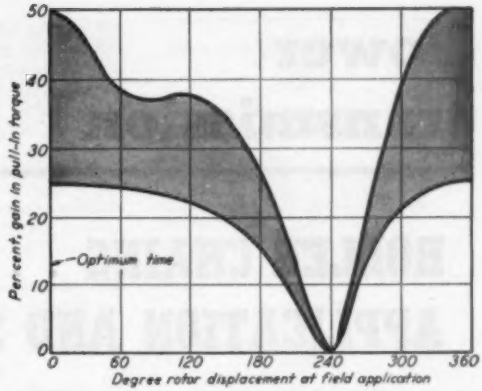



**Fig. 3—Selective field application allows a gain in pull-in torque over minimum values. The actual value falls in the shaded area, varies with rotor phase angle and machine**

on full voltage would have about 40 per cent direct axis transient reactance. Also, if the starting impedance is not modified by torque requirements, it will vary approximately as transient reactance varies with kva rating, speed, power factor and short-circuit ratio.

## Field Application Control

Many recent large pumping plants now in operation or under construction have control equipment for selective field application or "angle switching". This control connects the field circuit of the motor to its d-c supply at some favorable instant during the slip cycle after the motor has approached synchronous speed during starting. Chief advantage is that 25 to 50 per cent more load may be pulled into step as compared to field application at the least favorable instant, 240 deg in Fig. 3, during the slip cycle.

Although there are many possible circuits, a brief description of one will illustrate the operation. Induced field current, Fig. 4, causes a polarized relay to operate when its frequency becomes sufficiently low, usually 2 to 3 cps. This energizes a second polarized relay which operates during the next slip cycle when induced field current reaches a particular value, which, in turn, starts a timing relay to close the field breaker or contactor at the desired time.

Major benefit of selective field application lies in avoiding the least favorable period consisting of about one-third of the slip cycle. The standard field application control will do it at much less cost, although it may not be possible to apply the field at the exact optimum instant. Where a pump is started unwatered, there seems little need for more than standard control.

## Bearings

Operating the machine in either direction presents no new problems in bearing design. Large pump motors are usually required to operate without injury at reverse overspeed. The Kingsbury thrust bearing is inherently suitable and adjusts to either direction of rotation.

Guide bearings for large vertical pump motors are lubricated by two helical grooves in the bushing, one right and one left hand twist. Rotation of the shaft pumps oil upward in one groove regardless of direction.

Desirability of establishing an oil film in the thrust bearing before starting has been investigated. If minimum of starting torque and kva must be realized, a high pressure oil system can introduce oil at a hole in the center of each shoe with pressure sufficient to float the rotor on an oil film on the bearing surfaces before starting.

Infrequent requirements can be met be raising the rotor with the combination brakes and jacks normally furnished, and starting immediately after the jacks are lowered. The shoes must strip from the runner when the rotor is raised, and the runner is bolted to the thrust collar. Both systems involve hazards to normal bearing operation and neither should be used unless necessary in a particular application.

## Conclusion

Pumped storage hydro-electric plants will require electrical equipment of the same general nature as is now used in generating stations or pumping plants, and the special requirements of the application can be met without excessive development or unreasonable cost.

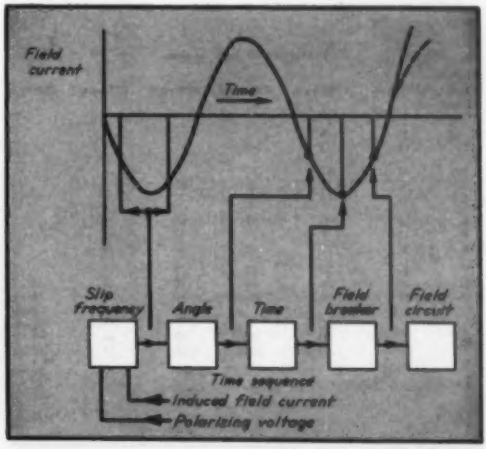



**Fig. 4—Selective field application includes several functions, each represented by a block in the proper time sequence shown. The final time of field energization can be chosen to give the gain in pull-in torque illustrated in Fig. 3. Except in difficult applications, the standard field controls are usually acceptable**

# Power transmission

*Engineering data and information to aid in selection, application and operation of equipment used in transmission of mechanical power*

# ROLLER CHAINS . . . APPLICATION AND SIZING

**First of a series of articles on the proper application, sizing, installation and maintenance of roller chains. Data will establish the best procedure in selecting the right roller chain to perform the most efficient job**

**RALPH A. MOLLER, *Associate Editor***

ROLLER CHAINS are employed to transmit mechanical power between two or more parallel shafts with practically no restrictions in the positions of the shafts, their rotating speeds or horsepower. Several combinations of design will undoubtedly solve a mechanical power transmission problem. However, for optimum durability and smoothness of operation, there is only one combination that will prove most effective.

In order to specify the size and length for this one combination the following data must be known: (1) horsepower to be transmitted, (2) full load speed of the fastest shaft, (3) desired speed of the slow speed shaft, (4) diameter of the driving and driven shafts, (5) center to center distance of the shaft, (6) position of drive and space restrictions and (7) drive conditions, steady or uneven, hours of operation, load and lubrication.

Selection of roller chain size and length is relatively easy when a standard electric motor is installed to drive a machine or line shaft, or if the drive is from a standard motor speed shaft. By knowing the speed and horsepower of the shaft the corresponding values of chain size (American Standards Number) and the minimum number of teeth required for the driving sprocket can be found from Table 1. The number of driving teeth permits computing the number of teeth in the driven sprocket and, this in turn, chain length.

When the driving force is not standard or must operate under abnormal conditions consulting the horsepower ratings of a manufacturer's catalog is necessary. However, the drive conditions should be analyzed to determine whether the actual horsepower should be adjusted to compensate for the abnormal conditions. This adjustment is made by multiplying the actual horsepower by a service factor, as indicated in Table 2.

After obtaining the adjusted horsepower and speed of the small sprocket, the horsepower rating tables are investigated. Size of chain required and number of teeth needed in the smaller sprocket can then be selected.

For multiple strand chains, divide

**TABLE 1—MINIMUM NUMBER OF TEETH IN DRIVING SPROCKET**

| Motor horse power | Motor full load speed | | | | | |
|---|---|---|---|---|---|---|
| | 1750 rpm | 1150 rpm | 850 rpm | 690 rpm | 570 rpm | 450 rpm |
| ½ | 15 | 15 | 15 | | | |
| ¾ | 15 | 15 | 17 | | | |
| 1 | 15 | 15 | 17 | | | |
| 1½ | 17 | 17 | 15 | | | |
| 2 | 17 | 15 | 15 | | | |
| 3 | 15 | 15 | 16 | | | |
| 5 | 18 | 22 | 17 | 17 | 19 | |
| 7½ | 17 | 19 | 22 | 17 | 18 | |
| 10 | 21 | 23 | 18 | 21 | 24 | |
| 15 | 21 | 18 | 21 | 18 | 17 | |
| 20 | 23 | 25 | 18 | 19 | 26 | 17 |
| 25 | 21 | 19 | 25 | 26 | 17 | 18 |
| 30 | | 25 | 18 | 17 | 19 | 26 |
| 40 | | 21 | 25 | 20 | 26 | 18 |
| 50 | | | 22 | 24 | 17 | 26 |
| 60 | | | 19 | 19 | 19 | 21 |
| 75 | | | | | | 21 |
| 100 | | | | | | 22 |

**TABLE 2—SERVICE FACTORS**

| Type of load | 10-hr day | | 24-hr day | |
|---|---|---|---|---|
| | Motor or turbine | Steam or gas engine | Motor or turbine | Steam or gas engine |
| Uniform | 1.00 | 1.20 | 1.25 | 1.50 |
| Uneven | 1.30 | 1.60 | 1.65 | 2.00 |
| Severely uneven | 1.40 | 1.70 | 1.80 | 2.20 |
| Shock | 1.60 | 1.90 | 2.00 | 2.50 |

**TABLE 3—MINIMUM CENTER DISTANCES IN INCHES**

| Pitch | ⅜ | ½ | ⅝ | ¾ | 1 | 1¼ | 1½ | 1⅝ | 2 | 2½ |
|---|---|---|---|---|---|---|---|---|---|---|
| Minimum center distances | 6 | 9 | 12 | 15 | 21 | 27 | 33 | 39 | 45 | 57 |

the adjusted horsepower by the number of strands, and the resulting value should be employed in selecting the chain and sprocket. In most cases several sizes of chains will be available. Selecting the proper size chain requires consideration of the degree of quietness, smoothness of operation, length of service and cost.

In choosing a chain drive the following basic rules should be kept in mind:

1. The smallest pitch chain should be selected that will give the desired horsepower well within the speed range listed.

2. Multi-strand chains of smaller pitch should be selected rather than one single strand chain of larger pitch, if quiet smooth operation is desired.

3. Less strands, even though lower in initial cost, do not operate smoothly. Furthermore, durability of such a chain does not prove satisfactory.

4. Selecting a sprocket with less than 17 teeth should be avoided.

Length of roller chain required for any specific drive is determined from the center distance between the shafts and the number of teeth in the driven sprocket. The number of teeth in the driven sprocket can be computed from the following equation:

$$T_2 = T_1 \times \frac{N_1}{N_2}$$

$T_2$, number of teeth in driven sprocket.
$T_1$, number of teeth in driving sprocket.
$N_1$, driving shaft speed, rpm.
$N_2$, driven shaft speed, rpm.

Maximum speed ratio recommended is ten to one, although higher ratios are sometimes used.

Center distance is the factor in a chain drive design that involves the extent to which a roller chain will engage a sprocket. The distance between two sprockets must be slightly greater than one half the sum of the outside diameters, or the teeth of the sprockets will interfere with each other. Center distances approaching this minimum should be avoided, because chain wear increases as center distances become shorter.

Chain length is found in a 5-step procedure. The number of teeth in the larger sprocket and the smaller sprocket are added together and divided by two. The sum of the teeth in both sprockets is designated as S.

The second step is to determine the difference in the number of teeth between the small and large sprocket. This is indicated as D. Value K is found directly from Fig. 1.

Dividing the center distance, in inches, by the pitch of the chain gives value C. Chain length in pitches is then equal to:

$$\frac{S}{2} + 2C + \frac{K}{C}$$

Chain length in inches is found by multiplying the chain pitches by the pitch of the chain.

For example determine the chain length under the following conditions: teeth in large sprocket, 60; teeth in small sprocket, 19; pitch of chain, $\frac{5}{8}$; center distance 24 in.

Step 1: $(60 + 19) \div 2 = 39.5$

Step 2: D $= 60 - 19 = 41$ and K (Fig. 1) is found to be 42.6.

Step 3: $C = 24 \div 0.625 = 38.4$

Step 4: Chain length in pitches is, $39.5 + (2 \times 38.4) + (42.6 \div 38.4)$ or 118.

Step 5: $L = 118 \times 0.625$ or 73.75 in.

*Acknowledgment is made to the Atlas Chain & Mfg. Co. for data in this article.*

**TABLE 4—OPERATING CLASSIFICATIONS**

**CLASS 1**

**Uniform load (8 hr service)**

**Agitators**—pure liquid

**Conveyors**—uniformly loaded or fed (apron, assembly, belt, flight, oven, screw)

**Fans**—centrifugal and light, small diameter

**Line Shafts**—light or normal duty

**Machines**—all types with uniform non-reversing loads

**Screens**—rotary (uniformly fed) traveling water intake

**Sewage Disposal Equipment**—inside service (uniformly fed)

**CLASS 2**

**Moderate shock load (9 to 24 hr service)**

**Clay Working Machinery**—pug mills

**Conveyors**—heavy duty and NOT uniformly loaded—operating on 24 hr service (apron, assembly, belt, bucket, flight, oven, screw)

**Cranes and Hoists**—medium duty, skip hoists (travel motion and trolley motion)

**Dredges**—cable, reel and conveyor

**Grinders**

**Line Shafts**—heavy service

**Machine Tools**—main and auxiliary drives

**Machines**—all types with moderate shock and non-reversing loads

**Screens**—rotary (stone or gravel)

**Textile Industry**—butchers, calenders, dyeing machinery, mangles, nappers, soapers, spinners, tenter frames

**CLASS 3**

**Heavy shock load (9 to 24 hr service)**

**Clay Working Machinery**—brick press, briquetting machinery

**Conveyors**—reciprocating and shaker

**Cranes and Hoists**—heavy duty including logging, lumbering and rotary drilling rigs

**Dredges**—cutter head drives, jig drives, screen drives

**Hammer Mills**

**Machine Tools**—punch press, shears, plate planers

**Machines**—all types with severe impact shock loads or speed variations, and reversing service

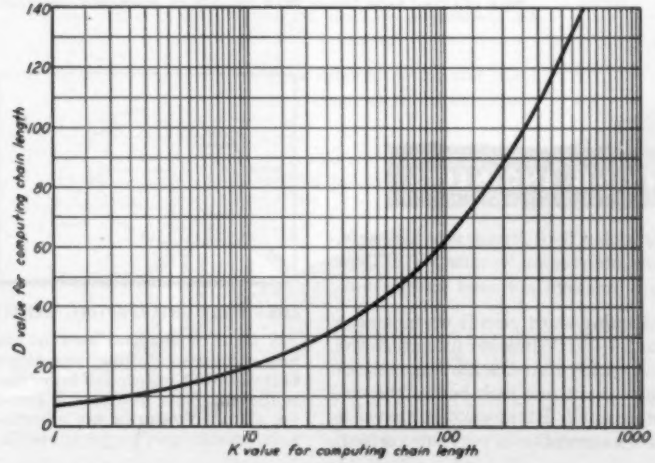
**Metal Mills**—draw bench, forming machines, slitters, small rolling mill drives, wire drawing or flattening

**Mills**—(rotary type) ball cement kilns, rod mills, tumbling mills

**Paper Industry**—calenders, dryers, jordans, presses

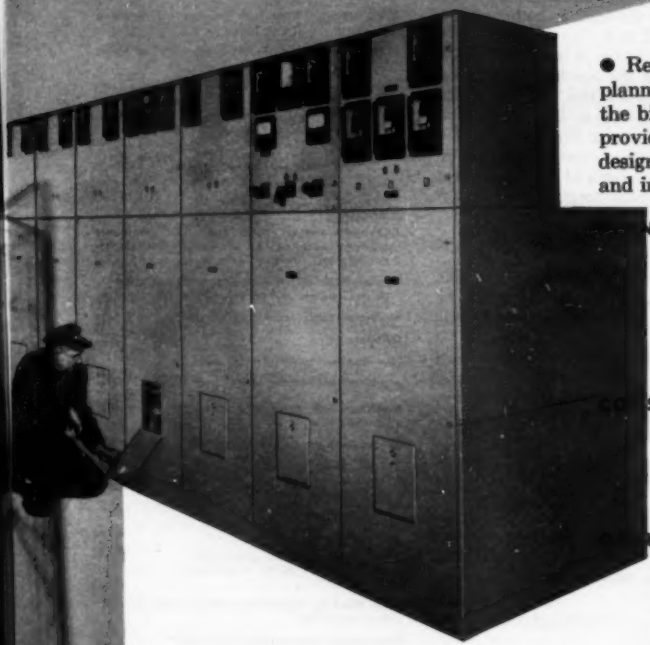
**Rubber Industry**—mixers, calender, rubber mill sheeter

**Textile Industry**—carding machinery




***Numerical difference between number of teeth in large and small sprocket, D, is located in the vertical scale of the graph. Value K is found by moving horizontally to the right until the curve is intercepted and dropping to horizontal scale for the reading***

# I-T-E METALCLAD SWITCHGEAR



● Regardless of your engineering responsibility—planning, construction, or operation—you'll welcome the big advantages that I-T-E Metalclad Switchgear provides. Since 1937 the soundness of the I-T-E design has proved itself in central stations, steel mills, and industrial plants the world over.

**NNING:** Planning engineers, concerned with plant wide equipment protection problems in new and expanded distribution systems, prefer I-T-E Metalclad Switchgear because for 15 years, it has assured safe, positive arc interruption. Planning is easier because I-T-E supplies indoor and outdoor equipments in standard structures that are compact, uniform, and readily expandable.

**STRUCTION:** Construction engineers like the way I-T-E speeds switchgear installation. I-T-E forwards channel bases in advance, so that floors can be prepared ahead of equipment arrival. The arrangement of I-T-E Metalclad Switchgear simplifies the pulling of primary and control cable.

**RATION:** Operating engineers have to live with switchgear once it's in place. They like I-T-E Metalclad Switchgear because double interlocking makes it safe and easy to operate. The famous "fast-test" feature makes short work of secondary circuit testing—even eliminates opening the breaker door.

**4160 VOLTS • 50,000 AND 150,000 KVA INTERRUPTING • 600, 1200, AND 2000 AMPERES CONTINUOUS**

For information, including selection and application data, write for Catalog Section 7004 and Bulletin 7000-A. I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pennsylvania.

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I-T-E Metalclad Switchgear provides safe, positive arc interruption because I-T-E Type HV circuit breakers are used throughout.

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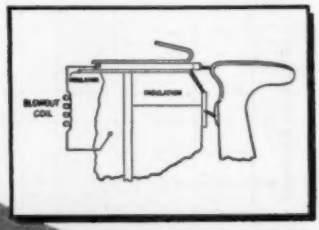


**LONG-LIFED INTERRUPTING ABILITY**

Arc transfer energizes blowout coil and eliminates metallic connection between front runner and lower current stud. Thus, potential is across arc chute only during arc interruption—resulting in longer chute life.

# PROVES ITS ENGINEER APPEAL

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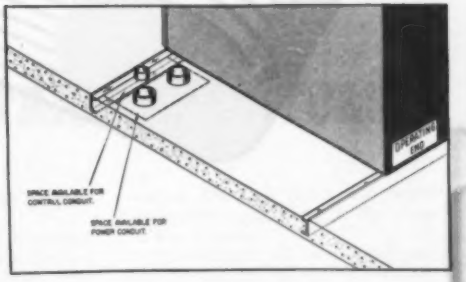


## OPERATING ENGINEERS

Important operating advantages of I-T-E Metalclad Switchgear save steps and guard your safety. Here are just a few of them:

1. Secondary circuit testing without removal of breakers from the stationary structure. No separate operation of secondary disconnecting devices is required.
2. The double interlock assures complete safety of personnel and equipment—guards against improper insertion or withdrawal of the circuit breakers. Interlocks are built into the circuit breaker—eliminating complicated engagement mechanisms between the breaker and structure. Adjustments are simplified and interchangeability is assured.
3. Circuit breaker control-relay is mounted on breaker truck; (when breaker comes out, relay comes out. No "climbing" into structure to inspect control-relay).
4. Truck-mounted horizontal removable elements eliminate hours of maintenance usually required for complicated elevator mechanisms.

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# Handbook for engineered plant services

*Methods, data and ideas that make excellent references in solving engineering problems frequently encountered in plant operations*

# SMALL PAPER DIELECTRIC CAPACITORS

Capacitors discussed here are of the fixed paper-dielectric hermetically sealed type. They incorporate improvements in materials and processing introduced during the past ten years, and are superior to the prewar line.

Capacitors considered are designed for normal motor, industrial control, filter, luminous-tube transformer, and other a-c or d-c applications within the limits given. Types designed for pulse, energy storage, high temperature, high frequency, and similar applications are not included.

Thin kraft paper is used as the solid dielectric, aluminum foil for the plates, and synthetic fluid for the liquid dielectric in the capacitors discussed.

## Rated D-C Voltage

The nameplate voltage rating of d-c capacitors is normally the maximum value for continuous 40 C ambient operation.

*Watt-second rating* denotes the energy storage capacity of a capacitor and can be calculated from the following equation:

$$\text{watt-seconds} = \frac{(\text{microfarads})\ (\text{kilovolts}^2)}{2}$$

This rating is an approximate indicator of the physical volume of the capacitor and is a factor in the establishment of life test specifications and voltage derating for high ambient temperature operation.

*Ripple Voltages.* Where alternating voltage is present in addition to direct voltage, the operating voltage determined from the curves in Fig. 1 applies to the sum of the direct voltage and peak value of the alternating voltage. However, the peak alternating voltage should not exceed the following percentages of the d-c value:

| | |
|---|---|
| 20% at | 60 c |
| 15% at | 120 c |
| 1% at | 10,000 c |

*Overvoltages.* D-c capacitors are normally designed to provide for intermittent variation in circuit voltage up to 10 per cent above the operating voltage found from Fig. 1. This value, however, shall not be applied to the capacitor more than 10 per cent of the operating time in any 24 hr period.

*Insulation Resistance.* The product of the nominal capacitance expressed in microfarads and the insulation resistance expressed in megohms should not be less than the values in Table I at the indicated temperatures, except that the insulation resistance need not exceed the values listed.

## Rated A-C Voltage

The nameplate voltage rating of a-c capacitors is normally the maximum value for continuous 40 C ambient operation. Derating curves for higher temperatures are given in the graph in Fig 2 below.

*Overvoltages.* All listed a-c capacitors are designed to provide for intermittent variations in circuit voltage up to 10 per cent above the operating voltage found from Fig. 2. This voltage, however, shall not be applied to the capacitor more than 10 per cent of the operating time in any 24 hr period.

*Frequency.* A-c capacitors are rated for 60 c, but may operate at rated voltage on circuits of lower frequency. When operation of standard units at a frequency higher than 60 c is under consideration, the matter should be referred to the manufacturer's representative for recommendations. He will check to assure that the volt-ampere loading at the higher frequency does not exceed the thermal limits of the unit and that the lead construction will handle the current involved. The following formula is for use in calculating the volt-ampere ratings of capacitors for any frequency:

Where

$VA = 2\pi FC E^2 / 10^6$

$F$ = frequency

$C$ = capacitance in mu f

$E$ = applied voltage

*Altitude.* Capacitors can normally be used at altitudes up to 7500 ft. Where higher altitudes are involved, special

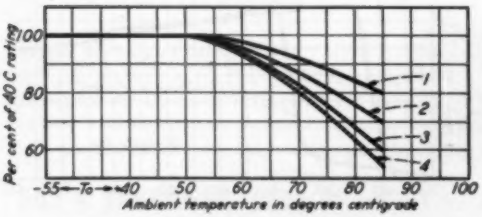


Fig. 1—Derating curves for d-c applications

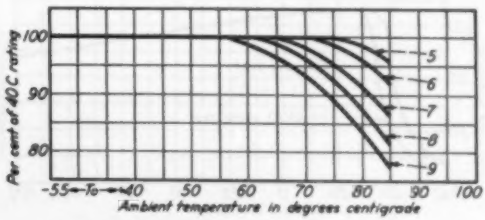


Fig. 2—Derating curves for a-c applications

designs may be required, and the manufacturer should be consulted.

## Capacitance Rating

The capacitance rating is listed in microfarads and is the nominal 25 C ambient rating. The standard manufacturing tolerance for capacitance is plus or minus 10 per cent.

*Elevated Temperatures.* For operation in ambient temperatures exceeding 40 C, operating voltage must be reduced below the rated value in order to obtain a minimum of one year's life when operated continuously in accordance with the other limiting factors. The operating voltage at ambient temperatures from −55 to +85 C, expressed in percentage of the rated voltage, can be obtained in Figs. 1 and 2.

Application ranges for curves in Fig. 1 are listed in Table 2. Curves in Fig. 2 are given here for illustration only since derating varies not only with size and voltage, but also with duty cycle. Starting with small, continuous duty units for curve 5, successively lower curves are used as size, voltage and severity of duty cycle (as in motor starting) increase.

## Acceptance Tests

The following tests are suggested as suitable for customer (equipment manufacturer) acceptance tests in addition to any measurements of characteristics.

*Tests for D-C Applications.*

1. Terminal-to-terminal voltage test:

Twice the 40 C rated d-c voltage for 15 seconds. Sufficient series resistance should be inserted to limit the current on charge and discharge to 1 ampere.

2. Terminal-to-case test:

(a) Where the case is not used as a terminal, test at twice the 40 C rated d-c voltage plus 1000 volts for 1 second.

(b) Where the case is used as a terminal, as in the case of multisection units, test at the terminal-to-terminal test voltage as above.

3. Life Test:

Table 2 below tabulates the per cent of rated 40 C d-c voltage to be applied for 250 hr at the ambient temperatures listed to qualify the capacitors for a minimum of one year's life when operated continuously in accordance with limiting factors. One failure from 12 samples is the recommended maximum to be permitted under this life test. In order to be effective the test must be made in a forced circulation oven with spacing between the capacitors and with no exposure to radiant heat.

*Tests for A-C Applications (Table 3).*

For special voltage ratings the terminal to terminal test voltage shall be determined by interpolation from the above table. The terminal to case voltage may be the value corresponding to the next higher voltage rating listed.

Sufficient series resistance should be inserted to limit the current on the terminal-to-terminal test, on charge and discharge, to 1 ampere maximum.

The terminal-to-case voltages specified in the above tabulation apply to standard capacitor units in which both electrodes are insulated from the case. Where a multisection unit is involved having the case as a common terminal, tests should include only those values listed under terminal-to-terminal.

D-c test voltages are used mainly to eliminate need for purchasing costly 60 c testing equipment and to minimize possibility of high-voltage resonant surges that could be damaging.

## Capacitance Vs Temperature

Figs. 3 and 4 are representative of capacitance variance with temperature for the capacitors discussed here. Measurements were made in an unenergized state. Since the magnitude of change differs somewhat with the capacitor rating and design, it is recommended that if exact characteristics for a specific rating are required, the manufacturer's representative be contacted.

*This material was abstracted with permission of the General Electric Co. from "Fixed Paper Dielectric Capacitors for A-c and D-c Applications".*

**TABLE 1 — INSULATION QUALITY**

| Temperature | Mu f x megohms | Insulation resistance, megohms |
|---|---|---|
| 25 C | 1500 | 4500 |
| 50 C | 150 | 1400 |
| 85 C | 15 | 450 |

**TABLE 2 — LIFE-TEST VOLTAGES**

| Voltage ratings | Watt-second classification | Derating curve | Per cent of rated d-c voltage 65 C ambient | 85 C ambient |
|---|---|---|---|---|
| 1000 and lower | 0 to 0.5 | 2 | 180 | 140 |
| | 0.5 to 5 | 2 | 170 | 130 |
| | 5 to 50 | 3 | 160 | 110 |
| 1500 to 2000 | 0 to 0.5 | 2 | 180 | 130 |
| | 0.5 to 5 | 2 | 170 | 110 |
| | 5 to 50 | 2 | 160 | 100 |
| | 50 and above | 4 | 155 | 85 |
| 2500 and higher | 0 to 0.5 | 1 | 165 | 110 |
| | 0.5 to 5 | 1 | 160 | 100 |
| | 5 to 50 | 2 | 155 | 90 |
| | 50 and above | 3 | 150 | 80 |

**TABLE 3 — D-C TEST VOLTAGES FOR A-C APPLICATIONS**

| Voltage rating of capacitor | Terminal to terminal | Terminal to case |
|---|---|---|
| 236 | 700 | 2000 |
| 330 | 1200 | 2000 |
| 440 | 2000 | 2400 |
| 550 | 2500 | 2800 |
| 660 | 3000 | 3200 |

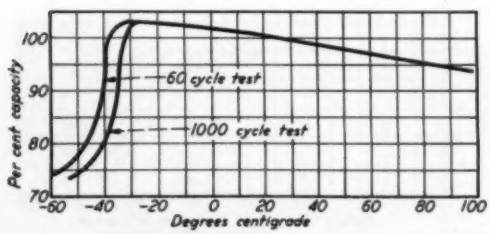


**Fig. 3—Temperature-capacitance variation, two frequencies**

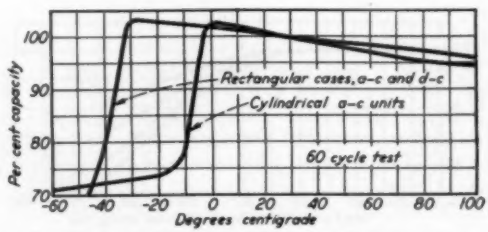


**Fig. 4—Temperature-capacitance change, two case styles**

*now you can reduce steam costs with the automatic*

**Powermaster®**

Model 3 *Powermaster*—15 to 500 H.P.; high or low pressure models for steam or hot water.

Exclusive burner design (patent applied for) is yours with the *Powermaster* steam generator. Compare this unit with others and you'll see why users are saving hundreds of dollars on fuel bills. Only the *Powermaster* gives you these 3 definite ways to reduce your costs for steam or hot water—

1. *Use less fuel* when boiler operates between 100% and 30% of capacity. Special burner gives you full modulation in a wide range between high and low fire.

2. *Save clean-up time* and money because complete combustion of fuel gives practically smokeless and carbon-free operation. Case histories show that the *Powermaster* needs cleaning less often than other self-contained units.

3. *Change from oil to gas* (or gas to oil) in just a few minutes. Take advantage of low fuel rates, enjoy freedom from worry about fuel shortages.

*only the* **Powermaster®** *gives you all 3 advantages*

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The rotor of a Terry Solid-wheel Turbine is a single forging of special composition steel. It is first rough turned in two operations, as illustrated, and then two cuts are taken to mill the semi-circular buckets from the solid metal. The wheel at the top has been finished, ready for mounting on the shaft. *The result is a single-piece wheel with no parts to loosen or work out.*

As the only function of the blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

It is impossible for the blades to foul. They have large clearances, and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry Solid-wheel Turbine is an extremely reliable piece of equipment. Why not write for complete details today?

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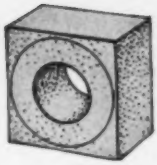
*Memo*

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

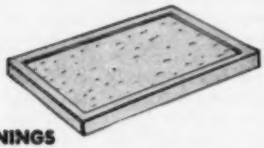
# *There's no end to the uses of economical*

# B&W KAOCAST



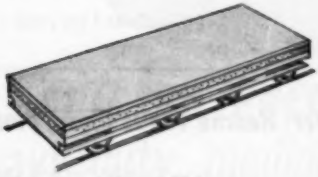
**BURNER BLOCKS**

**Kaocast lasted 3 to 6 times as long as previous refractory. Still going strong.**



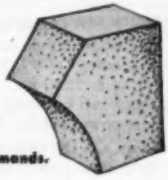
**DOOR LININGS**

**Kaocast lasted 3 to 6 times as long as previous refractory—cut installation cost in half.**



**TUNNEL KILN CAR TOPS**

**Ordinary fireclay crumbled after few trips. Kaocast lasted 30 trips without deterioration.**



**SPECIAL SHAPES**

**Kaocast special shapes cast over week-end to meet production demands.**

**BOILER FURNACE REPAIRS**

**One power plant keeps a ton of Kaocast on hand for miscellaneous repairs because it is so versatile.**

The list of plants who are discovering new, cost-saving uses of versatile B&W Kaocast keeps growing all the time. The reasons? This unique 3000 degree refractory castable can be molded in a hurry . . . cast directly in place . . . applied with a cement gun. It eliminates the need for a large inventory of special shapes. It has high resistance to spalling, low volume change, practically no reheat shrinkage. Want to know more? Ask your B&W Refractories Engineer—or write for Bulletin R-22.

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R-454

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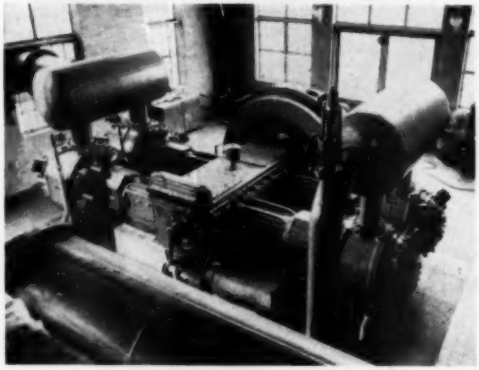
# Spot news

***Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants***

## Largest Air Compressor in Rouge Plant is Half Size of Older Units

Largest of the air compressors at Ford's Rouge plant is a balanced, opposed type unit manufactured by Clark Bros. Co. Despite its greater capacity of 10,000 cfm, it actually is only half the size of older units of substantially smaller output. It is a four cylinder, 17 in. stroke, two stage air compressor driven at 277 rpm by a 2000 hp synchronous



motor. The cylinders are mounted in pairs on a single frame and are connected to the crankshaft with throws 180 deg apart. The opposing cylinders cancel out each other's unbalanced forces, thus eliminating vibration. The foundation therefore needs to be only large enough to support the compressor's weight. Instead of the conventional mounting between compressor frames, the motor is integrally supported on the end of a one-piece forged steel crankshaft. No outboard bearing is needed.

Including the new unit, the Rouge plant has 28 compressors operating in eleven stations, with total capacity of 72,000 cfm. Electric motors used to drive these compressors total 15,440 hp. A continuous trend in this plant has been toward higher voltages. The new unit and one of the older units operate at primary distribution voltage of 13,200 v, thus eliminating transformers and the attendant power losses. Two others operate at 4600 v, five at 2300 v and the rest at 440 v.

## New Fluorescent Lighting System Effects Higher Levels of Light

A radically new lighting technique has been devised and placed in operation by General Electric illuminating engineers. Applied first at the U.S. Department of Agriculture's Plant Industry Station at Beltsville, Md., the technique involves use of a lighting system whose fluorescent lamps operate on 360 rather than the conventional 60 cycles.

A major benefit is reported in the form of 40 per cent increase in the amount of light available from the lamps, which are identical to fluorescent lamps now in use. This is accomplished by operating them at a higher current than would be practical at 60 cycles. Another important advantage is the substitution of tiny capacitors weighing only a few ounces for the large conventional ballasts weighing several pounds. The system also incorporates a magnetic converter to step up frequency from 60 to 360 c, in much the same manner as a transformer steps up voltage. Designed to provide maintenance free operation, the converter has neither rotary equipment nor electronic tubes.

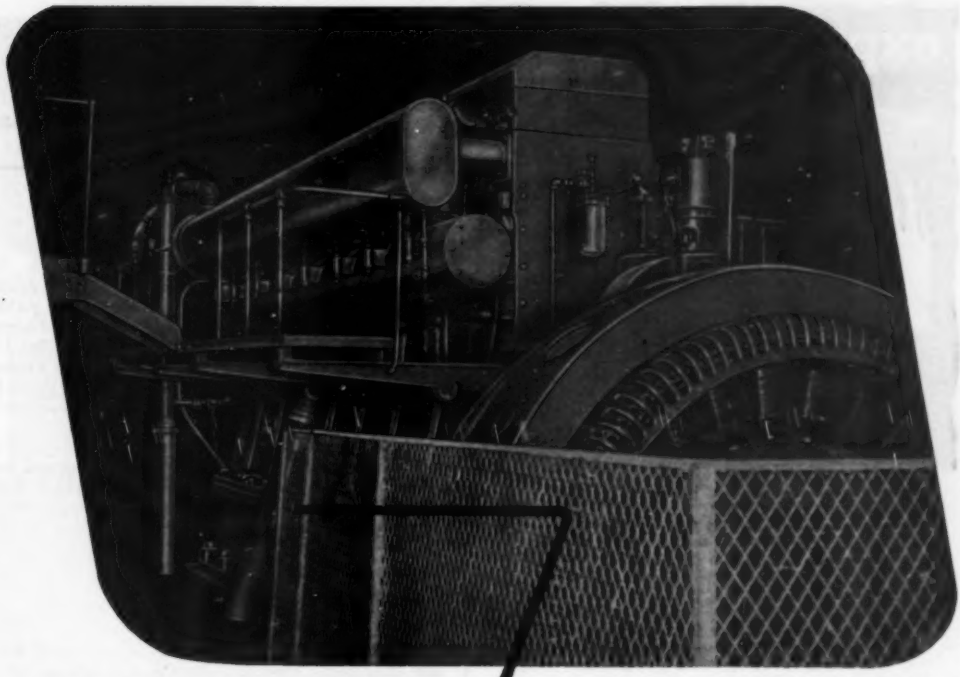
The new system is expected eventually to find wide application in large industrial plants and commercial buildings, replacing the current practice in many instances.

***( Continued on page 110 )***

## *The Cover-Hearne Texas Diesel Plant*

● On the cover of this issue of INDUSTRY AND POWER is Copper-Bessemer's Type LS 8-cylinder gas-diesel engine that is rated 1000 hp at 300 rpm while driving a 700 kw generator. This installation is located in the municipally-owned power plant of Hearne, Texas. The engine can operate on various proportions of gas and diesel fuel oil depending upon which is most economical. During the past year the municipality of Hearne, Texas installed another Type LS engine. This latter engine has been supercharged, which gives it a rating of 1715 hp at 327 rpm, and enables it to drive a 1250 kw generator. By supercharging a greater fuel economy is realized and up to 50 per cent more power out-put is said to be achieved.

Thirty-six years ago the citizens of Hearne decided to establish their own power plant. In the ensuing years, through profits realized in its operation, they have been able to improve numerous municipal properties. A few of these include their waterworks system, construction of a 93 acre municipal park embracing a nine-hole golf course; building a swimming pool with bath house; constructing a community club complete with auditorium, dining rooms and kitchen; paving 116 blocks of streets and making many other civic improvements. The operation of its utility systems produced enough profit to finance the entire expense of the city. The present utility system of Hearne is valued at over a half-million dollars, and with the exception of an original investment of $15,000, this valuation has been built entirely on plant earnings.



1500 H. P. Elliott Turbocharged CP Diesel installed in a midwestern utility plant.

# CHICAGO PNEUMATIC heavy duty, medium and slow speed DIESEL ENGINES

Whatever may be your horsepower requirements, there is a Chicago Pneumatic Diesel engine that will meet your needs. Available in sizes ranging from 120 H.P. to 1750 H.P., these engines can be furnished either for straight Diesel or for Dual Fuel operation.

The CP engine line includes both normally aspirated and supercharged engines. All supercharged engines incorporate the thoroughly dependable Elliott Turbocharger.

Years of reliable performance and low cost power have won for Chicago Pneumatic an outstanding position in the Diesel field.

CP Diesels have proved profitable investments for public utilities, industrial, municipal, ice and water-works plants, and in mining, oil, pipeline, cotton ginning and other fields where low cost, dependable power is a vital necessity.

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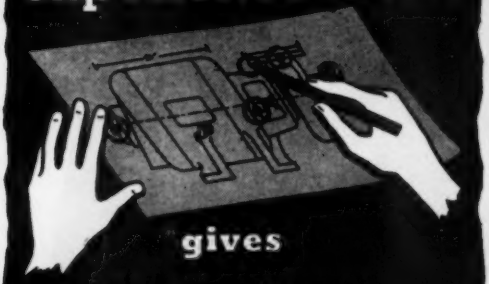
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

experience alone



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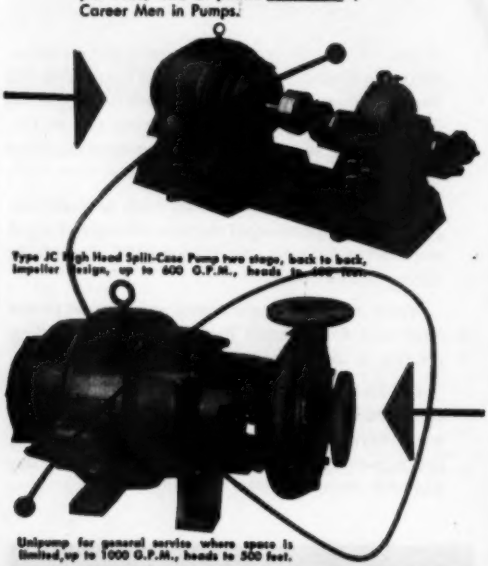
Extensive experience with all kinds of pumping applications makes any advice from a WEINMAN representative sound advice. He is backed by an organization which devotes its entire skill to the continuous improvement of one product—pumps. His head and his briefcase are crammed with ideas and engineering data on how liquids can be handled most effectively. This data plus common sense gained through experience can be applied to your problem to get the results you need. Plan to talk over your pump problems with a specialist—just write, wire or phone WEINMAN, Career Men in Pumps.



Type JC High Head Split-Case Pump two stage, back to back, impeller design, up to 600 G.P.M., heads to 600 feet.

Unipump for general service where space is limited, up to 1000 G.P.M., heads to 500 feet.

Built by Centrifugal Specialists

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REPRESENTATIVES IN PRINCIPAL CITIES


# Spot news

( Continued from page 108 )

## Compact Packaged Boiler Provides Efficient Heat for Valley Forge Chapel

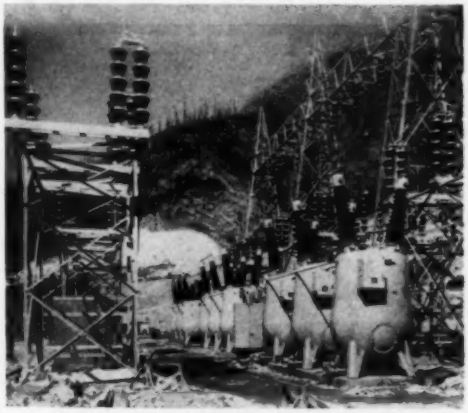
To heat a new chapel, the Valley Forge Military Academy at Wayne, Pa., recently installed a "Continental" packaged boiler made by the Boiler Engineering and Supply Company. This self-contained unit is rated at 35 hp, and has 127.6 sq ft of heating surface. The equipment measures a compact 120 in. long, 40¾ in. wide at the base and 46½ in. high from floor to flue outlet. Fuel used is light oil and operation is fully automatic.

This type of packaged boiler is an improved 2-pass Scotch Marine type. All fuel is burned in the integrated boiler furnace which is fully surrounded by water. The gases pass spirally through 3 in. tubes. The only refractory required is at the back of the boiler.

## Easily Installed Baffles Are Efficient in Reducing Noise Level

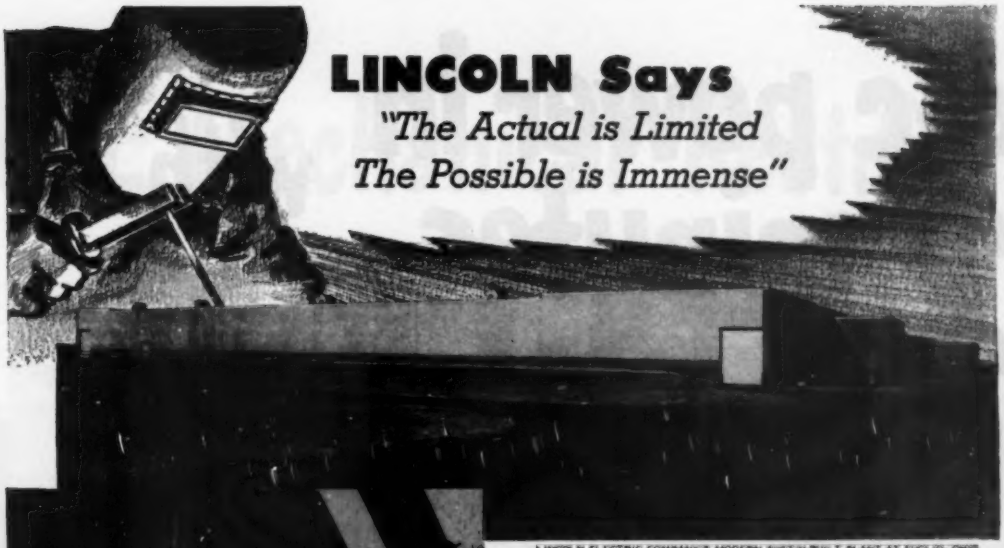
Acoustical baffles designed to reduce loudness of factory and shop noises have been developed by Owens-Corning Fiberglas Corporation. Easily and economically installed, they consist of a rigid panel of preformed Fiberglas insulation, measuring ½ x 24 x 48 in., completely enclosed in a printed plastic film. The film covering acts as a drumhead, transmitting sound by vibration into the insulation. They are hung with tying wires which are looped and twisted around overhead wires strung horizontally at the desired

( Continued on page 114 )



**WATCH-CASE BREAKERS AT BONNEVILLE**

*Here are the first three Westinghouse "watch-case" circuit breakers at Detroit Dam of Bonneville Power Administration. They are rated 230/182 kv, 7500 mva interrupting capacity*



# LINCOLN Says

*"The Actual is Limited*
*The Possible is Immense"*

LINCOLN ELECTRIC COMPANY'S MODERN AUSTIN-BUILT PLANT AT EUCLID, OHIO

**BOILER and STOKER DATA**

| | |
|---|---|
| BOILERS | 2-ERIE CITY 2-DRUM (550 hp.) |
| CAPACITY | 38,000 pounds STEAM per hour |
| DESIGN PRESSURE | 160 lbs. |
| FIRING EQUIPMENT | 2-ERIE CITY DUMPING GRATE SPREADER STOKERS |
| FUEL | OHIO BITUMINOUS |

## We Agree - Here's Why

Erie City Iron Works is proud to have Erie City Boilers and Stokers installed in Lincoln Electric Company's modern Austin-built plant at Euclid, Ohio.

As the oldest boiler builder in America, we well remember when the "Actual" in the Lincoln motto seemed to us to be "limited" by the skill of the riveter. Today, thanks to the great advance in welding science, we find "Possibilities Immense." Today, Lincoln welded seams are routine in all Erie City Boilers, and former potential trouble points are transformed into the strongest parts of the boiler shell.

There's a modern Erie City Boiler to meet any steam demand. Outline your requirements.

ERIE CITY
112 Years In Steam Generation

**ERIE CITY IRON WORKS** • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

# d-c power in 2 minutes with an

Practically instantaneous starting is one of the many advantages you get by using the I-T-E Mechanical Rectifier. This source of low-cost d-c power in the 50 to 400 volt range can be on the line, operating at full load, within 2 minutes of the time the starting button is pushed. Even less time is required if the rectifier is not used in parallel with other types of d-c sources.

There are only 5 quick steps to starting—4 to stopping the equipment. These are easily performed by unskilled labor.

I-T-E Mechanical Rectifiers have no large rotating masses which must be brought up to speed before going on the line. No warm-up period is required—no waiting for vacuum build-up. This means the I-T-E Mechanical Rectifier has maximum availability for your process.

For further information, write I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pennsylvania. Ask for Bulletin 5106.

The 10,000 ampere mechanism pictured will supply d-c power to a chlorine cell line.

### INSTALLATION IS FAST, TOO!

A complete installation can be unloaded, installed and placed in operation in a relatively short time. This is possible because of:

- Packaged delivery.
- Factory-wired and labeled control circuits.
- Truck-mounted, movable rectifying units.
- Overhead bus (no trenches or basement preparation).
- Compactness of the design.

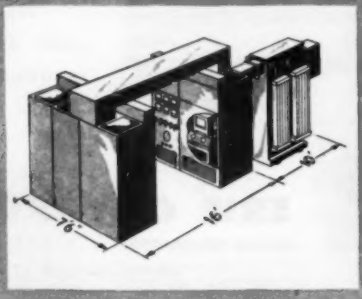
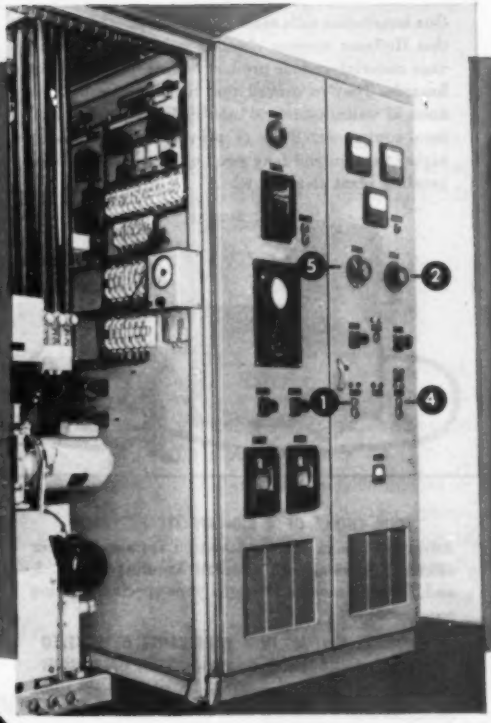



Diagram of typical mechanical rectifier installation. All elements of the unit including operating aisle are arranged in an area of 120 square feet. This does not include area occupied by transformer which is usually located outdoors.

# I-T-E Mechanical Rectifier

*All you do to start the*
**I-T-E MECHANICAL RECTIFIER**

1. Push button to close a-c breaker.
2. Adjust d-c voltage to desired value.
3. Close d-c disconnect switch. (Not Shown)
4. Push button to close d-c breaker—you're on the line!
5. Adjust d-c current to desired value—automatic current regulator will hold that value—within ±1%!




**I-T-E MECHANICAL RECTIFIERS OFFER THESE ADVANTAGES:**

*HIGH EFFICIENCY*
96% or more in the 50 to 400 d-c voltage range.

*SMALL SPACE REQUIREMENT*
compact design, neat appearance.

*LOW BUILDING INVESTMENT*
no need for special foundation or unusual construction.

*LOW INSTALLATION COST*
put rectifier in place, connect, operate.

*AVAILABILITY FOR SERVICE*
no warming-up or speed-up period.

*LOW MAINTENANCE COST*
main contacts need only occasional replacement.

*RUGGED TRANSFORMERS*
conservative construction—latest design.

*SIMPLE VOLTAGE CONTROL*
voltage or current automatically controlled between ±1%.

I-T-E

## MECHANICAL RECTIFIERS

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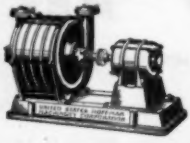
**HOFFMAN** *Heavy-Duty*
*VACUUM CLEANING EQUIPMENT for Wider Range Dust Removal!*

One installation sells another, as plant after plant finds that Hoffman vacuum cleaning units save labor—salvage material—reduce product defects—eliminate dust hazards. They've proved that they can clean larger areas of walls, floors and overhead surface with Hoffman equipment. Built to provide bigger capacity, higher vacuum and long years of service on the most grueling plant cleaning jobs.

**YOUR CHOICE OF 4 BIG-CAPACITY PORTABLES**
Advanced design and construction features for fast, efficient cleaning, with one-man handling. 1½, 3, 5, and 7½ H.P. models to match your specific cleaning requirements

**STATIONARY SYSTEMS IN A WIDE RANGE OF SIZES TO FIT YOUR MAINTENANCE OR PRODUCTION OPERATIONS**
Provides cleaning in several areas at the same time. Sweepers attach cleaning hose to conveniently located inlets (in a permanently piped system). Dust is removed pneumatically to central collectors for easy disposal.

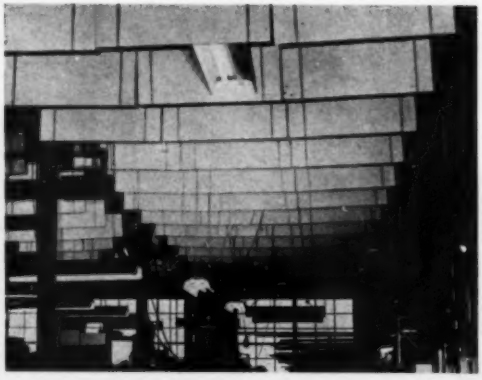
**MULTISTAGE CENTRIFUGAL BLOWERS AND EXHAUSTERS**
For agitation of liquids, combustion, mixing—for all air requirements (including the elimination of compressed air). No internal moving parts. Low power consumption. Adopted as standard in steel plants, textile and ice plants requiring 24-hour continuous service. Wide range of pressures, capacities and vacuum, for air or gas. Tell us your requirements.



AIR APPLIANCE DIVISION **U.S. HOFFMAN MACHINERY CORPORATION**
100 EAST 42nd STREET, NEW YORK 17, N.Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO. LTD. HEMMARKET, ONT.


# Spot news

*( Continued from page 110 )*

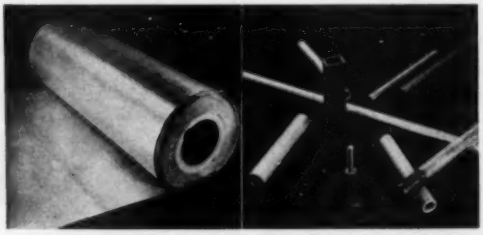


height. They may be hung above or below the ceiling lights and in one or more tiers.

They are expected to be used widely in areas where cost of installing standard types of acoustical ceilings would be prohibitive due to ceiling obstructions often found in plants and shops. Results of tests indicate that the baffles, when installed in a high noise level area, provide a loudness reduction of from 30 to 60 per cent.

## Mica in the Form of Paper Makes Use of Domestic Sources

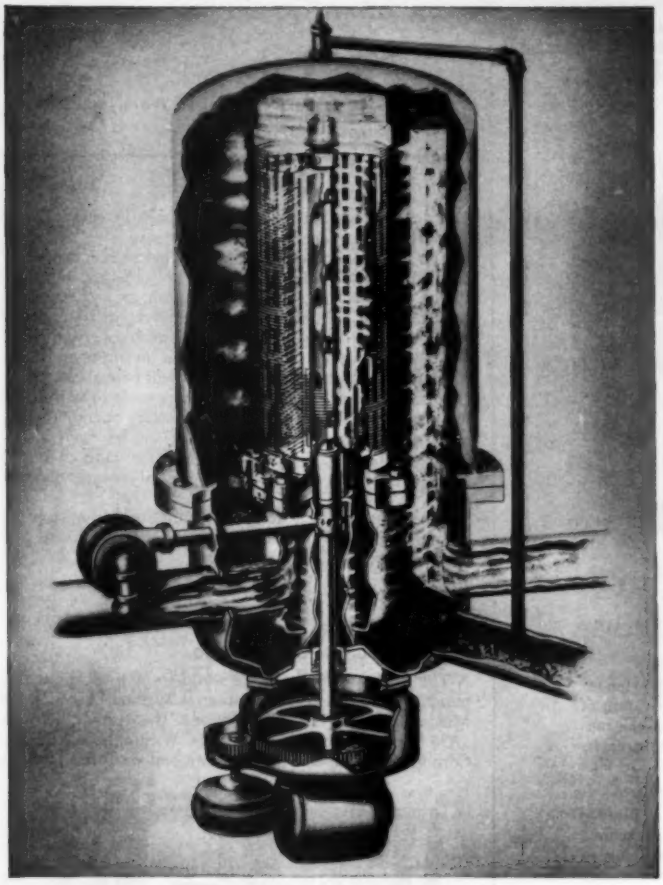
Most of the mica used by electrical and other industries in this country is imported from foreign sources. Reliance on these sources may soon be ended by adoption of a new mica



***Roll of mica paper, uniform in weight and thickness, and miscellaneous forms fabricated from the paper. Built-up mica paper can be machined, punched, tapped and threaded***

paper produced from domestic scrap or muscovite previously too small for use. This will constitute a significant advancement in the concepts of micaceous insulation. The raw mica is reduced to a pulp by chemical and heat treatment,

***( Continued on page 116 )***



# How many times do you re-use your water?

Cut water *waste* and water *bills*. Make used process water fit for re-use by running it through a Cuno FLO-KLEAN strainer. Also—a low-cost way to clean raw river or lake water for industrial use.

CUNO

*Fluid Conditioning*

**Removes More Sizes of Solids from More Kinds of Fluids**

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

## Works without Attention to Furnish Clean Water —Cheap

This is the way many industrial plants solved the problem of high water bills and low water supplies.

They use Cuno FLO-KLEAN Strainers to remove trash from raw water . . . or to reclaim used process water.

Some users have saved enough to pay for their FLO-KLEANS in a few months!

The FLO-KLEAN is a large-capacity (up to 20,000 gpm), corrosion- and abrasion-resistant strainer which positively removes all solids larger than specified.*

## Continuously Self-Cleaning

Operation is continuous—with never a stop for cleaning the FLO-KLEAN. This eliminates the need for a duplex installation.

Self-cleaning is accomplished by an automatic backwash system which makes a further saving of water by recycling the backwash.

So—with continuous cleaning of the cartridge and automatic top and bottom blow-down, there's nothing to worry about. FLO-KLEAN can be installed in some remote place and forgotten.

*May be specified from .090 in. down to .0025 in.

Cuno Engineering Corporation
Dept. 142F, South Vine Street, Meriden, Conn.

Please send information on Cuno FLO-KLEAN for straining raw water . . . . . reclaiming process water . . . .

Name . . . . . Title . . . . .

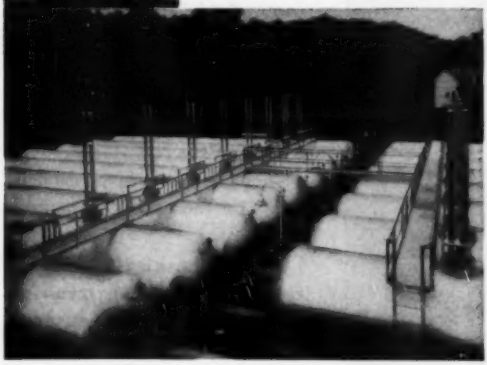
Company . . . . . .

Address . . . . . .

City . . . . . Zone . . . . State . . . . .

*Please attach to business letterhead*

## Avoid Plant Shut-Downs Due to Gas Failure!



## Install a Pritchard LP-Gas Standby Plant.

**Wintertime gas supply failures need no longer be a threat to the uninterrupted operation of your plant. Now you can be sure of continuous operation and production during emergency periods with a Pritchard LP-Gas Standby Plant.**

**There is no need to switch over to a more costly year-round fuel either! A Pritchard LP-Gas Standby Plant uses *low-cost* liquefied petroleum gas and can be easily turned on in a matter of minutes without extra burner equipment or adjustments. Fuel can be delivered by rail or truck at any time and stored for future emergency use. Butane or propane-butane gas mixtures can be used interchangeably.**

**Don't let the bogey of gas supply failure cause unnecessary shut-downs of your plant! Let Pritchard's experienced gas engineers give you an estimate on a Pritchard LP-Gas Standby Plant engineered to your specific requirements. Your inquiry invited.**

J.F. Pritchard & Co.

DESIGN · ENGINEERING · CONSTRUCTION

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District Offices: CHICAGO · HOUSTON · NEW YORK · PITTSBURGH
ST. LOUIS · Representatives in Principal Cities from Coast to Coast


# Spot news

*( Continued from page 114 )*

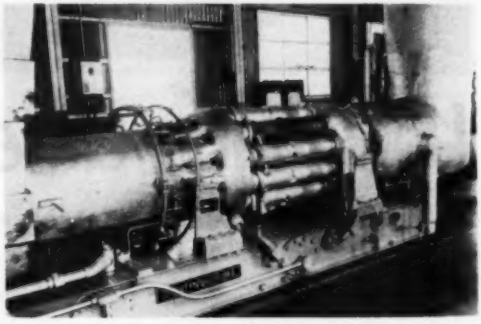
and then formed into thin coherent sheets by an adaptation of conventional paper making techniques.

The Mica Insulator Company has announced a new grade of products made from this material. Mica paper, according to the company, does not compare with mica splittings in mechanical or electric properties; however in combination with suitable bonding agents, products with superior properties can be produced. Homogeneity and uniformity of thickness are two great advantages which will be realized. Many products formed from this paper can be made to satisfactory tolerances without the necessity for milling operations, and articles formerly difficult to produce can be easily made. When used for segment plates it shows no tendency to split or flake, it has high dielectric strength and a degree of hardness close to that of copper.

A new plant for the domestic manufacture of mica paper is presently under construction near Rutland, Vt. Initial production is expected later this year.

### Mississippi River Fuel is First to Operate Gas Turbine

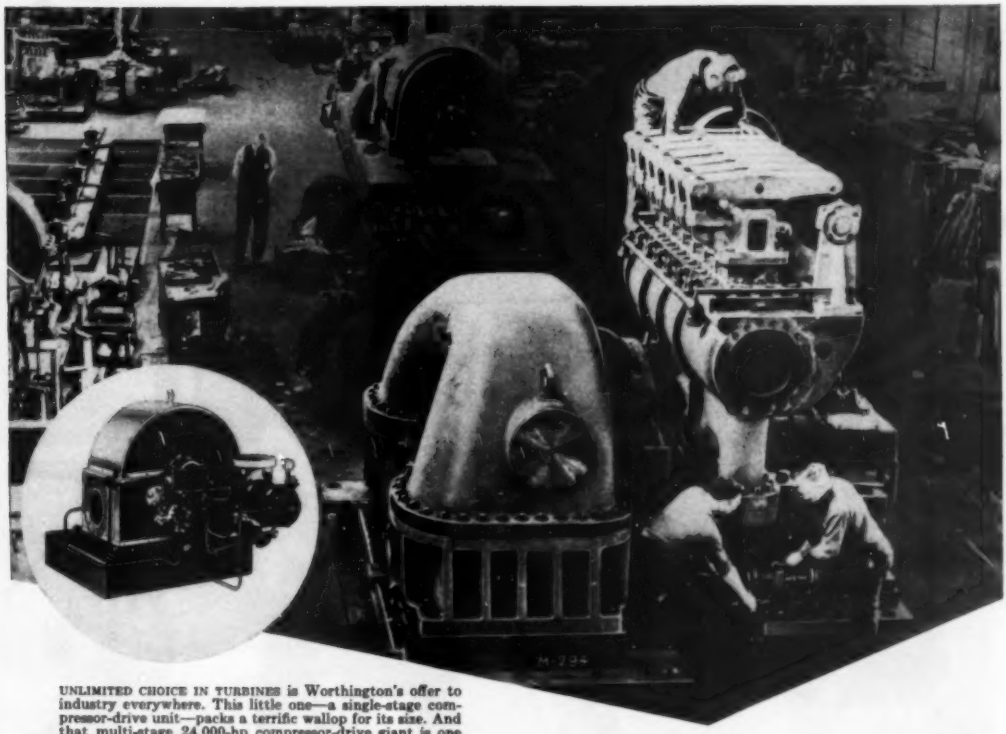
The first gas turbine in the world to be used in gas line pumping was placed in operation at Wilmar, Ark., by the Mississippi River Fuel Corporation. This turbine, rated at 1850 hp, was originally built by Westinghouse Electric Corporation as an experimental unit and was placed on test



in 1946. It was later modified to make it suitable for gas line pumping. It also has the distinction of being the first commercial gas turbine unit to be operated in the United States using natural gas fuel.

With the recent completion of a parallel high pressure line, the unit was no longer required at Wilmar. Therefore it was recently moved to Farmington, Mo. In this new location it is used in winter to "pack" the end of the line and increase deliveries, and in summer to maintain required pressure.

***( Continued on page 144 )***



UNLIMITED CHOICE IN TURBINES is Worthington's offer to industry everywhere. This little one—a single-stage compressor-drive unit—packs a terrific wallop for its size. And that multi-stage 24,000-hp compressor-drive giant is one of the largest ever built for this type of service.

# Single-stage midgets to multi-stage giants

Whether your turbine requirements call for the biggest or the smallest—straight condensing . . . straight non-condensing . . . extraction . . . mixed pressure extraction . . . low pressure . . . high back pressure . . . for mechanical or generator drive . . . with governors for constant or variable speed—*Worthington has an answer.*

Each Worthington turbine is designed to make the steam do *more* work, so you save power and money throughout its long life.

Learn more about Worthington turbines. Get the facts on why *there's more worth in Worthington* by writing to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.

7.2.2

A GREAT TEAM IN STEAM

WORTHINGTON

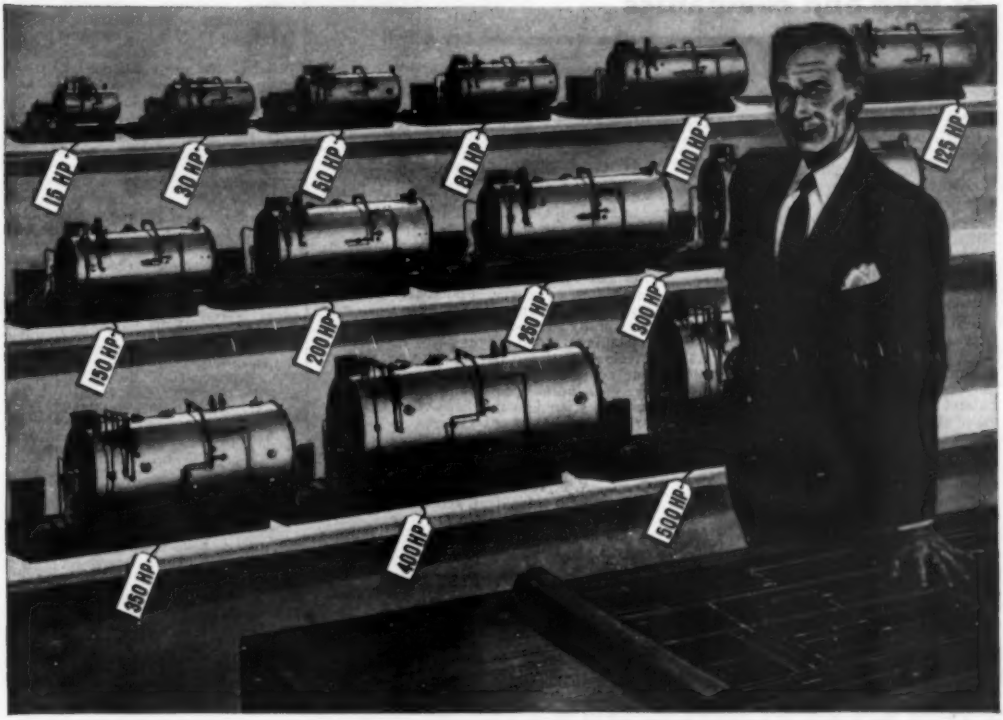
Steam Turbines

Yes, Chapman makes cast steel gate, globe and check valves, to ASA and API ratings . . . for all pressures and purposes and in all sizes.

*So file this mental note:* It pays to check with Chapman on *all* your valve requirements, standard or special. Have you the latest edition of Catalog 20 covering Cast Steel Valves? It's yours for the asking.

**The CHAPMAN VALVE Manufacturing Company**
INDIAN ORCHARD, MASSACHUSETTS

# Selecting The Right Boiler Is Most Important...

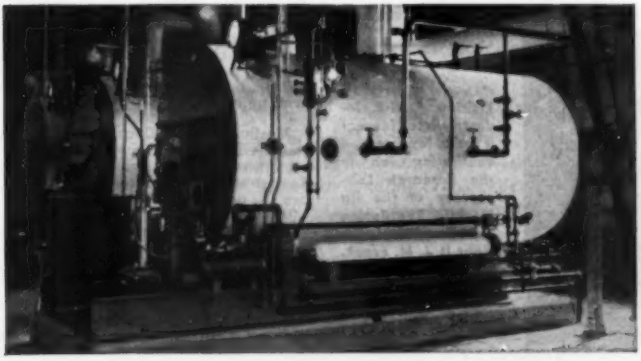



Cleaver-Brooks does not sell steam boilers "off the shelf" even though the boilers are available in standard models. Working with you, your engineers, and your consulting engineers Cleaver-Brooks helps analyze your particular steam needs and loads, both present and future.

These are a few of many factors considered: steam requirements in pounds per hour or b.h.p. — constant or fluctuating loads — fuels available — electric current characteristics — space and boiler room layout — provision for expansion.

Application engineering assistance of this kind assures you a steam plant tailored for your job. Cleaver-Brooks are the first and finest in modern, self-contained steam boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 200 p.s.i.

*Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.*



**Cleaver-Brooks**
**STEAM BOILERS**

CLEAVER-BROOKS COMPANY
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*Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners*

# News
## of men and companies

### ANNIVERSARIES

**The Lunkenheimer Co.**—Observance of their 90th anniversary keynoted the firm's 1952 sales conference in Cincinati, Ohio. Officials and sales personnel from all over the United States and many foreign countries participated in the annual conference.

### HONORS

**Allis-Chalmers Manufacturing Co.**—Dr. S. H. Mortensen, chief electrical engineer for the power dept was recently installed as an Eminent Member of Eta Kappa Nu Association. Eminent Membership in the electrical engineers' honor society is "offered only to those individuals who by their technical attainments and contributions to society have shown themselves to be outstanding leaders in the field of electrical engineering and great benefactors to their fellow men."

**Builders Iron Foundry**—D. J. Purdie, sales engineer and district office mgr of the New York branch office for Builders-Providence, Inc., Omega Machine Co., and Proportioneers, Inc., was recently honored for having completed his 40th consecutive year of service. Also honored for 40 years' service was H. Zoglio, asst supt of the foundry.

**California-Oregon Power Co.**—Chosen outstanding engineer of Oregon in 1951 for his work in hydro-electric power development, J. C. Boyle, genl mgr and acting chief engineer, was awarded the Professional Engineers of Oregon Certificate of Merit.

**General Electric Co.**—Dr. K. B. McEachron, mgr of the laboratories-engineering dept of the transformer and allied products div, was recently initiated into Eminent Membership by the Eta Kappa Nu Association. The society also named L. C. Gitzendanner, engineer in the general engineering laboratory, the outstanding young electrical engineer of 1951. B. R. Lester, electronics div laboratory, and R. L. Trent, Bell Telephone Laboratories, received honorable mention awards.

Three engineers in the laboratories-engineering dept of the transformer and allied products div were awarded the Mathewson Gold Medal for outstanding achievement in the field of metallurgy. Recipients of the award were C. G. Dunn, F. W. Daniels, M. J. Bolton and F. Lionetti. Lionetti, a former laboratory employee, is currently an instructor in biochemistry at the Boston University School of Medicine. The medal is awarded for the paper or series of closely related papers with at least one common author, which represents the most notable contribution to metallurgical science in the three-year period preceding the award. There has only been one previous award of this medal.

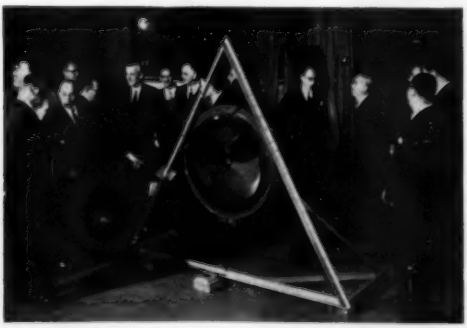
**Worthington Pump & Machinery Corp.**—A. F. Welsh, mgr of the reciprocating pump sales dept, received a sapphire-studded service pin in recognition of his 25 years' service with the company.

### SALES OFFICES

**Petro-Chem Development Co.**—Announce their move to new headquarters in the Chanin Bldg. at 122 E. 42nd St., New York City.

**The Glidden Co.**—The Nubian Industrial Div. will move its executive, sales and accounting offices into the McClosky Varnish Co. building across the street from the present offices at 1856 North LeClaire Ave., Chicago.

**Hewitt-Robins, Inc.**—Will move its headquarters offices from 370 Lexington Ave., New York, to Stamford, Conn. about April 1st. The eastern div and export sales offices of the Hewitt Rubber, Restfoam and Robins Conveyors Div. will remain at 370 Lexington Ave; offices of Robins Engineers Div. will continue at 157 Chambers St., both in New York City.



***Visiting British industrialists inspect a sound level test on ventilating fan in the Research Laboratory of the Ilg Electric Ventilating Co. Fourth from right is J. M. Frank, Ilg president***

### HIGH FREQUENCY INDUCTION & DIELECTRIC HEATING EQUIPMENT

All users of induction and dielectric heating equipment, particularly those whose equipment was manufactured prior to June 15, 1947, should know the provisions of the FCC Rules and Regulations, Part 18, relating to radiation and communication interference from industrial induction and dielectric heating equipment.

*In essence the rules require certification, on or before June 30, 1952, of compliance with certain minimum radiation requirements for all equipment installed or manufactured prior to July 1, 1947. A period of five years was allowed by the Commission for users of uncertified equipment to properly check and obtain certification of their equipment. The deadline date is rapidly approaching and all such users of uncertified equipments should take steps to comply with the commission's rules.*

It is suggested that users of older type equipments contact the manufacturer or a consulting engineer for guidance. A complete copy of the FCC Part 18, Rules and Regulations Relating to Industrial, Scientific and Medical Service, may be obtained from the United States Government Printing Office, Washington, D. C.

**Brundy Engineering Co., Inc.**—Moved into the recently completed administrative headquarters building off the Boston Post Road in Norwalk, Conn. The new building now houses the personnel and functions of these depts: executive, sales, accounting, technical service, research, advertising, development, and clerical. The New York district sales office will continue at 107 Bruckner Blvd., New York City.

### EXPANSIONS

**Delta-Star Electric Co.**—This div of H. K. Porter Co., Inc., announced a half-million dollar plant expansion which will provide 30,000 sq ft of additional assembly and machine shop space.

**De Laval Steam Turbine Co.**—Announced the formation of a subsidiary, the De Laval Turbine Pacific Co. Headquarters will be in the new building at Main and Folsom Sts., San Francisco, Calif. Company officers are: G. W. Smith, Jr., chairman, J. P. Steward, president, C. F. Reeves, v-p and genl mgr. Branch sales offices are located in Los Angeles, Calif., under H. H. Reynolds, district mgr, and Seattle, Wash., headed by J. A. Greenland, district mgr.

**Marlin-Rockwell Corp.**—Construction has been started on the $3 million air-conditioned, ball-bearing plant near Jamestown, N. Y. Wigton-Abbott Corp., are the designers and builders.

**Perfect Circle Corp.**—Has signed contracts with the stockholders of the Centrifugal Foundry Co., Muskegon, Mich. for the purchase of their entire stock holdings on or before March 31, 1952.

***( Continued on page 122 )***

# LOW COST DEPENDABLE COAL HANDLING FOR PUBLIC UTILITIES

Salem Gas and Light Company, Salem, Mass., found a G-W Skip Hoist the ideal solution to the problem of conveying coal and coke to producer storage. The skip bucket keeps the producer-storage bin filled at all times . . . and does the job with maximum economy.

Gifford-Wood Skip Hoists . . . one of many G-W systems of materials handling . . . are low in initial cost . . . low in maintenance . . . long-lived . . . completely dependable. Public utility companies the country over are becoming increasingly interested in Skip Hoist handling of coke, coal and ashes where space is limited and both initial and operating costs must be kept at rock bottom.

This particular installation may not be the perfect solution to your own particular problem. Gifford-Wood, however, has specialized in the design, engineering and installation of all types of materials handling systems for 136 years. To have a Gifford-Wood Materials Handling Engineer survey your present method of moving materials, places you under no obligation and it may well be your first step toward lower operating costs and increased production.

**GIFFORD-WOOD CO.**

Since 1814
HUDSON, NEW YORK

NEW YORK 17, N. Y. 420 WASHINGTON AVE. • ST. LOUIS 1, MO. RAILWAY EXCHANGE BLDG. • CHICAGO 6, ILL. 565 W. WASHINGTON ST.

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*When You Think of Materials Handling — Think of Gifford-Wood*

JOBS LIKE THESE!

Lovejoy Countershaft Unit controls speed of automatic Spring Coiler

Lovejoy Wide V-Belt Pulley included in design of Tapping Machine

...depend on

LOVEJOY
VARIABLE SPEED
PULLEYS

Whatever *your* job calls for — you, too, can depend on Lovejoy Variable Speed Pulleys to operate machinery at exactly the right speed. Quickly, easy, finger-tip control — no stops for speed changes. Simple installations on old or new equipment. Shipped from stock for fractional to 8 H.P. duties. And ask about the new, low-cost Lovejoy Tilting Motor Base for fractional motors up to ¾ H.P.

*Write now for complete Catalog and engineering data*

LOVEJOY FLEXIBLE
COUPLING COMPANY

**5043 W. Lake St. Chicago 44, Ill.**

*Also Mfrs. of Lovejoy Universal Joints and Lovejoy Flexible Couplings*

# News

**of men and companies**

*( Continued from page 120 )*

**Monsanto Chemical Co.**—Construction of a 250-ton sulfuric acid plant on an 86-acre site at Avon, Calif., is planned. The plant, which will utilize waste sludge and hydrogen sulfide piped from the adjacent Tide Water Associated Oil Co. refinery, will be owned jointly by Monsanto and Tide Water Associated.

**Samica Corp.**—This new company, incorporated in Delaware, will make high grade mica electrical insulation from domestic scrap or small Muscovite mica which has hitherto been unusable. It will use a French process, which has been patented in this country and will be in production in the near future. Participants in the new organization are: Prosilis, S. A. of Paris, France; the Swiss Insulating Works of Breitenbach, Switzerland; and the Mica Insulator Co., Schenectady, N. Y.

**American Agile Corp.**—Announces completion of a new 12,500 sq ft building located at 5461 Dunham Road, Maple Heights, Ohio.

**The Babcock & Wilcox Co.**—Started construction on a new plant in Paris, Tex., for the manufacture of components for large utility and industrial boilers. It will also assemble smaller FM boilers. Total area under roof in the new plant will be 135,000 sq ft.

**Benbow Mfg. Co.**—Reorganization was completed this month. Former sales outlets have been replaced with a coast-to-coast system of engineering organizations that handle both sales and service. The company has moved to its new plant at 1285 Rollins Road, Burlingame, Calif.

**Leland Electric Co.**—American Machine and Foundry Co. announces it has signed an option to acquire all assets of Leland Electric Co. in return for AMF common stock.

**Purolater Products, Inc.**—Acquisition of Petroleum Accessories, Inc., of Detroit, was announced.

**Reliance Electric & Engineering Co.**—Sales offices in both Detroit, Mich., and Cleveland, Ohio, have been moved to larger quarters. The Detroit office is now located at 12326 Hamilton Ave. Cleveland district sales office is now operating from 13967 Cedar Road, Cleveland 18, O.

**Sylvania Electric Products, Inc.**—Has set up a new executive dept to supervise the planning of plant expansion and has placed v-p C. A. Haines in charge as director of facilities planning. Headquarters of the new dept will be located in Salem, Mass.

## NEW REPRESENTATIVES

**Zurn Services, Inc.**—Appointment of the John B. Foley Co. is announced as representative for the sale of Zurn Industrial Div. products. This company will service the eastern portion of New York State.

**American Flexible Coupling Co.**—U. & S. Inc., Syracuse, N. Y., is appointed sales representative for central and eastern New York.

**Strong, Carlisle & Hammond Co.**—Will distribute Borgana boiler water treatment on a national basis. Borgana, a trade-marked organic product extracted from red cedar, is manufactured by the Portland Shingle Co., Portland, Ore.

**American Flexible Coupling Co.**—Sam F. Patterson is appointed representative. Announcement is made by Zurn Western Services, Inc., Erie, Pa. His territory will be Washington and northern Idaho.

**Cleaver-Brooks Co.**—Announces the appointment of the V. N. Harwood Co., Buffalo, N.Y., as a manufacturer's representative. The firm, managed by Van Ness Harwood, is located at 250 Delaware Ave. Its territory will include eight counties in western New York, and four counties in northwestern Pa.

## APPOINTMENTS

**Allis-Chalmers Manufacturing Co.**—J. C. Pohlman is named application engineer in the transformer section in charge of regulator sales for the southwest and central regions. H. S. Bimpson is now chief engineer of the steam turbine section, and C. D. Wilson is engineer-in-charge of steam turbine design. W. H. Billings and R. P. Gundersen are assigned as asst engineers to the blower and condenser section.

**Aluminum Company of America**—J. P. Growdon is now a consultant on hydraulic and related engineering problems for the company. His former position as chief hydraulic engineer is filled by B. J. Fletcher.

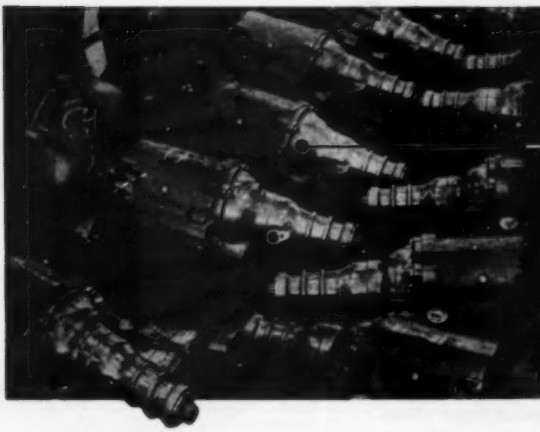
**BullDog Electric Products Co.**—L. H. Hopper is promoted to asst eastern div mgr and will make his headquarters

**G. P. Koenig** **L. H. Hopper**

at 101 Park Ave., New York. G. P. Koenig fills the New York district mgr's position vacated by Hopper.

**The Babcock & Wilcox Co.**—Appointment of C. Carl as supt of the West Point, Miss. works is announced. A. P. Cramp, company plant engineer, who came to West Point to direct construction of the new plant, will remain in charge of that operation until it is completed.

*( Continued on page 124 )*



THE INVISIBLE TOOL

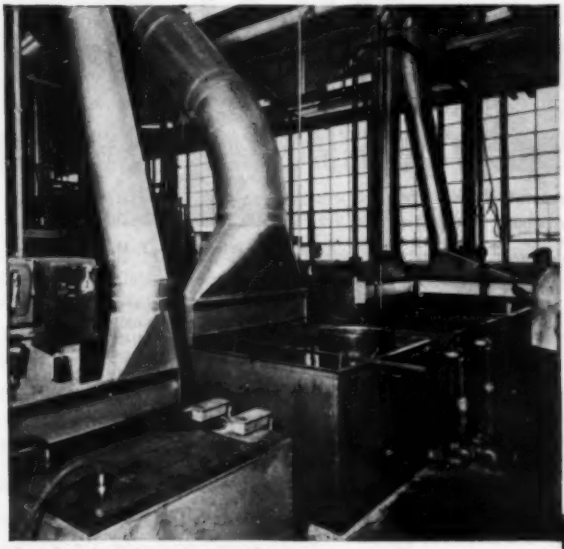
*at work in the*

# FORD AUTOMATIC TRANSMISSION PLANT

NUMBER 2 OF A SERIES

## KIRK AND BLUM SYSTEMS

## REMOVE SMOKE FUMES IN QUENCHING

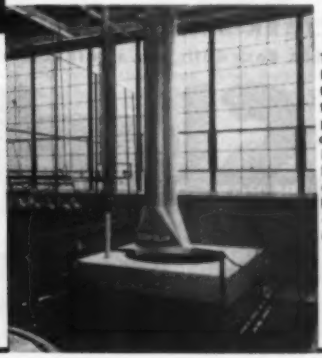


Cross Draft hoods leave these quenching tanks completely accessible also.

The large quantities of smoke, fume and even flames produced in quenching operations must be carefully and completely controlled. The advanced design of Kirk & Blum hoods and piping makes this a practical reality.

In the ultra-modern Ford Motor Company Automatic Transmission Plant, 37 distinct KIRK & BLUM Systems aid in the production of Merc-o-Matic and Ford-o-Matic transmissions. In heat treating, quenching, welding, cleaning, machining, woodworking, maintenance and assembly operations, they provide "Clean Air . . . the INVISIBLE Tool" in this model plant.

Let the 45 years' experience of KIRK & BLUM work for you. Write for literature. The Kirk & Blum Manufacturing Co., 3174 Forrer St., Cincinnati 9, Ohio.



The Kirk & Blum hood shown on this oil quench tank permits complete freedom of operation and visibility as parts baskets are lowered into the oil. Flames and smoke are effectively controlled.

## KIRK AND BLUM

**FUME CONTROL SYSTEMS**

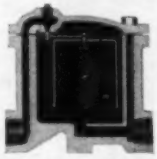
**Clark CONTROLS**
**CAN SAVE YOU MONEY**
***All Down the Line!***

If dollars are running through your steam lines it's time Clark Controls took over. Water in steam lines wastes fuel, cuts efficiency and adds greatly to maintenance costs.

Clark Steam Traps, with Duo-Stop Leverage, drain *twice* the condensate of ordinary traps. Clark Controls on your lines is truly like money in the bank. Write us for full details.

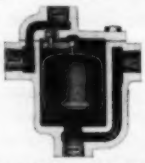
**QUICK CLEANING STRAINERS**

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" P.S.I.



**SERIES "70" Inverted Bucket Trap**

One of the most popular in the Clark line. Continuous flow capacities up to 2600 lbs. per hour. Sizes ½", ¾" and 1". Pressures up to 200 P.S.I.



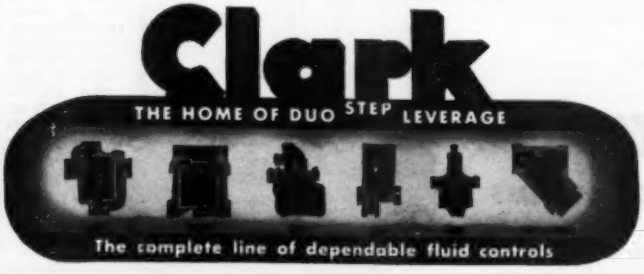
**SERIES "60" Inverted Bucket Trap**

Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-loy" guided disc and seat.

**SERIES "450"**

For continuous flow drainage. Pressures up to 600 P.S.I. Sizes ½" to 2". External discharge valve; "Clark-loy" disc and seat.

**THE CLARK MANUFACTURING COMPANY**
**1854 East 38th St. • Cleveland 14, Ohio**





# News

**of men and companies**

*( Continued from page 122 )*

**Black, Sivalls & Bryson, Inc.**—Announces appointment of J. E. White, Jr., as safety head sales representative for the gulf coast area, with offices in Houston.

**Bailey Meter Co.**—Announces appointment of W. Powell, Jr., as mgr of the Buffalo, N. Y. branch office.

**Borg-Warner Corp.**—Capt. E. E. Roth, U.S.N. (Ret.), is appointed director of engineering of the LVT Section, in the Kalamazoo, Mich., works of the Ingersoll Products Div.

**A. M. Byers Co.**—C. G. Jensen, v-p and controller, is retiring. Succeeding him as controller is R. Griem.

**The Cuno Engineering Corp.**—Elected Carlton H. Winslow v-p in charge of sales. He was formerly asst genl mgr.

**C. H. Winslow** **T. M. Lamberth**

**The Cooper-Bessemer Corp.**—T. M. Lamberth, Jr. is appointed sales and engineering representative at the Shreveport, La., office where he will be under the direction of A. K. DeFrance, branch mgr.

**DeLaval Steam Turbine Co.**—J. H. Metzgar is appointed sales mgr of the Standard Products Div. The new sales mgr of the commercial div is C. E. Cromwell.

**William F. Clapp Laboratories, Inc.**—Directors elected A. P. Richards president and director of the laboratories to succeed the late Dr. W. F. Clapp. The laboratories are said to be international authorities on teredos, shipworms and other destructive marine organisms. Those concerned with the preservation of waterfront structures will welcome the news that this organization is to remain active in this field for research and consultation.

**Fansteel Metallurgical Corp.**—Appointments for the recently organized rectifier-capacitor div are: G. Ramsey, genl mgr; O. S. Aikman, sales mgr; R. T. Morrison, sales engineer; E. W. Lincoln, mgr of production planning; and J. H. Hall, mgr of product engineering.

*( Continued on page 126 )*

# You've got a Winning Combination

A STANDARD ISA FACE-TO-FACE DIMENSIONS
K "FLOW LINE" CONTOURED BODY
Q STELLITED SEATING SURFACES
J REMOVABLE SEAT RINGS
10 SEAT RINGS EASILY REPLACED WITH VALVE IN PIPE LINE

with the New TRADE LESLIE MARK

## DOUBLE SEATED DIAPHRAGM CONTROL VALVES

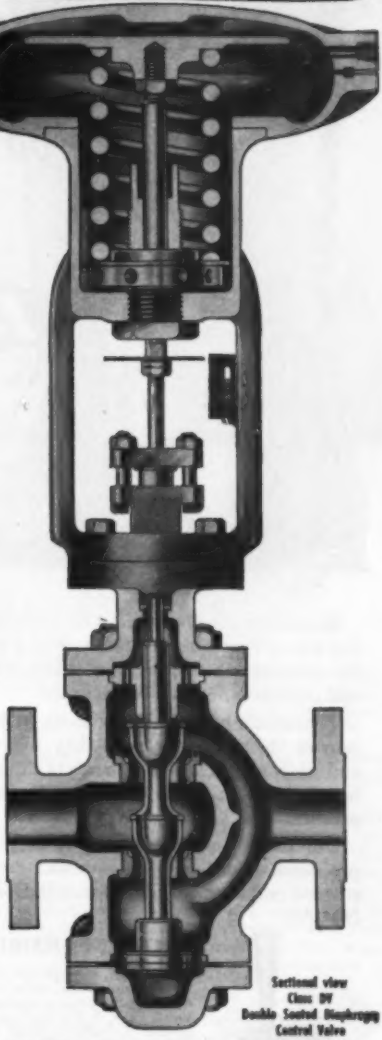
***Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.***

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of uneveness of bolt tightening.

Standard, integral stellited seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as *standard equipment*, features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

| | | | | | |
|---|---|---|---|---|---|
| Albany, N. Y. | Chicago, Ill. | Galveston, Tex. | Memphis, Tenn. | Orlando, Fla. | Salt Lake City, Utah |
| Albuquerque, N. M. | Cincinnati, Ohio | Greenville, S. C. | Miami Springs, Fla. | Philadelphia, Pa. | San Francisco, Calif. |
| Atlanta, Ga. | Cleveland, Ohio | Houston, Texas | Milwaukee, Wis. | Pittsburgh, Pa. | Seattle, Wash. |
| Baltimore, Md. | Dallas, Texas | Indianapolis, Ind. | Minneapolis, Minn. | Ponca City, Okla. | St. Louis, Mo. |
| Beaumont, Tex. | Denver, Colo. | Kansas City, Mo. | Mobile, Ala. | Providence, R. I. | Syracuse, N. Y. |
| Birmingham, Ala. | Des Moines, Ia. | Kingsport, Tenn. | Monroe, La. | Richmond, Va. | Tucson, Ariz. |
| Boston, Mass. | Detroit, Mich. | Los Angeles, Calif. | New Orleans, La. | Rochester, N. Y. | Wilkes-Barre, Pa. |
| Bridgeport, Conn. | El Paso, Tex. | Louisville, Ky. | New York, N. Y. | Rutherford, N. J. | Wilmington, Calif. |
| Buffalo, N. Y. | | | | | Youngstown, Ohio |

Bruxelles-Forest, Belgium

Montreal, Que., Can. • Ottawa, Ont., Can. • Toronto, Ont., Can. • Vancouver, B. C., Can. • Welland, Ont., Can.

**WRITE FOR Bulletin 513**

ESTABLISHED 1900
LESLIE CO.

263 Grant Avenue, Lyndhurst, New Jersey

7707

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES

Single or double fan installations with automatic controls. Double operates on single furnace, or serves two. On single furnace either fan can operate up to 70 percent capacity; other fan then cuts in automatically.

TYPE 1 TYPE 1A

TYPE 2

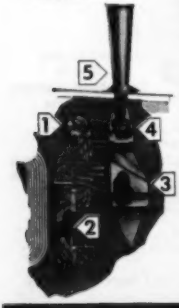
TYPE 2A

TYPE 3

You eliminate fluctuations or losses in draft efficiency by the use of Prat-Daniel Stacks. P-D Fan Stacks coordinate the relationship of fans, breeching and stacks to provide and maintain maximum efficiency.

Thousands of P-D Fan Stacks in long operation have proved their superior reliability over induced-draft fans and stacks purchased separately. Easily applied to any installation, they provide highly efficient draft for the load conditions of your power plant.

Our project engineers provide expert assistance on any problems of draft production and control. Call them on current problems or planned installations. Write for Catalog No. 200.




**UNIT RESPONSIBILITY**

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream shown at left; 1. Forced Draft Fans, 2. Air Pre-heaters, 3. Tubular Dust Collectors, 4. Induced Draft Fans and 5. Fan Stacks. This unit responsibility, by a well-known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

*Sales and Project Engineers*

**THE THERMIX CORPORATION**
GREENWICH, CONN.

*Canadian Affiliates:* T. C. CHOWN, LTD.
1440 St. Catherine St., W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

*Designers and Manufacturers*

**PRAT-DANIEL CORPORATION**
SOUTH NORWALK, CONN.


# News
**of men and companies**

*( Continued from page 124 )*

**Childers Mfg. Co.**—Announces appointment of J. F. Templeton to handle sales of aluminum pipe jacketing in Ga., Ala., and north Fla.

**General Electric Co.**—H. L. Weiss succeeds L. G. Cover who retired as mgr of two factories of the lamp div. Plants involved are the Cleveland Wire Works, Euclid, O., and the Dover Wire Works, Dover, O. E. W. Cunningham is named genl mgr of the industrial heating dept.

**Hyatt Bearings Div.**—This div of General Motors Corp. has transferred H. J. Conlan, asst div engr, to the Pittsburgh office of the central sales div.

**Illinois Institute of Technology**—Dr. J. T. Rettaliata, v-p and dean of engineering, is named president.

**Diamond Power Specialty Corp.**—W. J. Fitzburgh, former exec v-p, is now president. W. P. Thomas is elected chairman of the board.

F. N. Kemmer W. J. Fitzburgh

**National Aluminate Corp.**—F. N. Kemmer, formerly with the Cochrane Corp., has recently assumed a position as chemical engineer, ion exchange dept with Nalco. He will be the eastern representative of the ion exchange dept, and will continue to live in Hartsville, a Philadelphia suburb.

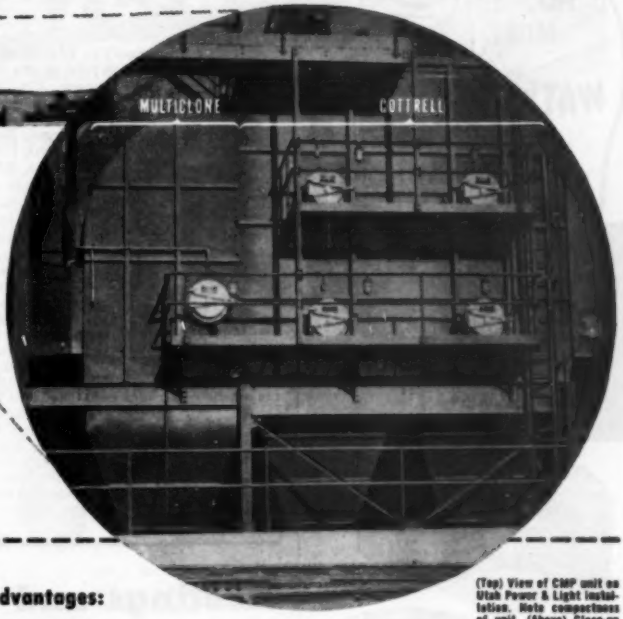
**Kaylo Div.**—Reorganization of the insulation sales force for this div of Owens-Illinois Glass Co. is announced. The plan provides for three regional supervisors, and under them are five new branch mgrs. Promoted to regional sales supervisors are T. F. Sears for the southwestern district, offices in Houston; L. F. Scott for the midwest from Chicago; and R. L. Long who will cover the east from the main office in Toledo. Branch mgrs are A. B. Pike, Boston; C. Ramien, Philadelphia; R. L. Major, Pittsburgh; I. Keith, St. Louis; and J. D. Hailey, Cleveland.

**Link-Belt Co.**—Dr. L. C. Marshall is named director of the company's new physical testing and research laboratory at Indianapolis. He is also currently head of the Microwave Laboratory at Berkeley, Calif., operated by the U. S. Air Forces and the Research Corp.

*( Continued on page 129 )*

*Planning A Fly Ash Recovery Installation?*

# Consider these important advantages of a WESTERN PRECIPITATION CMP UNIT!




(Top) View of CMP unit on Utah Power & Light installation. Note compactness of unit. (Above) Close-up of same installation.

**IF YOU are planning the installation of any type of fly ash recovery equipment—mechanical or electrical—it will pay you to investigate the extra advantages to be gained by installing a CMP Unit designed, engineered and constructed under *one* responsibility by Western Precipitation Corporation—*leaders in both electrical and mechanical recovery fields!***

## Combines Mechanical and Electrical Advantages:

**A CMP (Combination Multiclone-Cottrell Precipitator) Unit combines—in one compact installation—both mechanical and electrical recovery principles, so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally cleans the gases of the larger and heavier fly ash particles (down to a few microns in diameter)... and the COTTRELL Precipitator then electrically removes the very small particles remaining in the gases. This combination arrangement has important advantages:**

**1.** Using the MULTICLONE for cleaning out the heavier particles permits the bulk of the recovery operation to be performed with relatively low-cost equipment.

**2.** Using the COTTRELL for final clean-up insures unusually high recovery efficiency—approaching theoretically perfect, if desired—with a high efficiency, compact Precipitator unit.

**3.** Each type of unit—MULTICLONE and COTTRELL—can be arranged for its most efficient application. MULTICLONES may be connected to each separate boiler, if desired, and their draft requirement cut out when the boiler is down... while a central COTTRELL handles all gases and operates at higher efficiencies, with continued low power cost, when one or more boilers are down.

**4.** During soot-blowing periods, or while warming up cold boilers, the MULTICLONE efficiency usually increases, preventing overloads of detrimental carbon from reaching the COTTRELL.

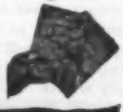
## Only Western Precipitation Combines Multiclone and Cottrell "Know-How"—in ONE Organization!

A vital factor in obtaining maximum efficiency and economy in CMP installations is the proper balance of mechanical and electrical recovery equipment to the individual requirements of *each* application. Western Precipitation is unique in that it not only pioneered the commercial application of COTTRELL Electrical Precipitators over 43 years ago, but also has been a leader for many years in the *mechanical* recovery field with its widely-recognized MULTICLONE Collectors.

*Result*—Western Precipitation has the all-important "know-how" and experience in BOTH fields... knows from first-hand experience how to fit the *right* equipment in the *right* place, to do *your particular* job ... and can provide the complete installation under ONE responsibility and ONE overall guarantee!

**Let Our Experienced Engineers** study your recovery requirements and make recommendations on the equipment best suited to your operations. A wire, phone call or letter to our nearest office places this unique "Know-How" at your service, without obligation!

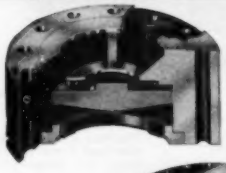
*Send for descriptive literature!*



WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1036 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 LaSALLE ST. BLDG., 1 N. La SALLE ST., CHICAGO 2 • HOBART BUILDING, SAN FRANCISCO 4, CALIFORNIA
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL



Wherever Williams-Hager flanged Silent Check Valves are installed, plant maintenance men will tell you their costly water hammer troubles are over. These dependable, durable and compact valves can be placed in your water system in any position, including angular, and will provide maximum protection at all times. They are available for every service in standard pipe sizes from 1" to 20". Why not rid your plant of water hammer *now* . . . get Williams-Hager Check Valves.

CHECK VALVES

Write for Bulletin WH 851

Write today for your copy of this informative bulletin on Water Hammer, its Cause, Effect and Control in Piping Systems.

**THE WILLIAMS GAUGE CO.**

3100 PENNSYLVANIA AVE. • PITTSBURGH 33, PA.


# Reviews of recent books . . .

***Recent books, published for men responsible for the Engineered Plant Services, are reviewed here. Write to the publisher for those in which you are interested***

**Fuels**

**"Energy Sources—The Wealth of the World", by Eugene Ayres of the Gulf Research & Development Co., and Charles A. Scarlott, editor of Westinghouse Engineer. Order from Industry and Power, Reader's Service Dept., St. Joseph, Mich. 344 pages with 114 illustrations and 60 tables. Price, $5.00.**

How long fuel supplies will last and what we can do against the day when they are exhausted is discussed in an interesting manner in this book. Figures for the size of reserves for oil, coal, oil-shale, peat, and tar-sand are evaluated. The meaning of "proved oil reserves" is clarified. Efficiencies of energy consuming devices and conversion processes are analyzed, and energy losses in such processes as production, mining and transportation are weighed. Sources which may supplement the common fuels when they are exhausted are discussed, and energy values including land and marine vegetation, wind and tide, earth heat, atmospheric electricity, and the Claude process are explained. Nuclear energy and the utilization of solar power are examined. Also presents a thought-provoking energy balance.

**Corrosion**

**"How to Prevent Corrosion", third edition, by Frank N. Speller, corrosion consultant. Order from Industry and Power, Reader's Service Dept., St. Joseph, Mich. 664 pages with 177 illustrations and 60 tables. Price, $10.00.**

This book discusses the theory of corrosion and presents practical descriptions of all known methods for combating it. Dealing mainly with the ferrous metals, the new edition is rewritten to include many of the advances in practical preventatives, such as biological influence and cathodic protection.

Described in the first section is the generally accepted electro-chemical theory of corrosion. A system for classification of corrosion phenomena and testing is also presented. The second part applies principles of corrosion prevention under most of the commonly found conditions. To increase its value to the engineer, the book includes such topics as corrosion resistance of numerous ferrous alloys, effects of various gases and compounds, specifications for corrosion testing, preparation of surfaces for coating, and methods of mitigation.

# Meetings and exhibitions

***Announcement of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings***

**MARCH**

**National Power Show—American Power Conference.** Being held concurrently March 25-28, 1952, at the Hotel Sherman, Chicago, Illinois. Write A. F. Thompson, Director of Exhibits, 176 West Adams Street, Chicago 3, Illinois.

**National Association of Corrosion Engineers** holds its Eighth Annual Conference and Exhibition at the Pleasure Pier in Galveston, Tex., March 10-14, 1952.

**National Plastics Exposition** will take place in Exposition Hall, Philadelphia, March 11-14, 1952. For further information write Harry W. Smith, Inc., 507 Fifth Ave., New York 17, N. Y.

**Chicago World Trade Conference** will be held in the Hotel Sherman March 6-7, 1952. The Chicago Assn. of Commerce and Industry, 1 N. LaSalle St., Chicago.

**Chicago International Trade Fair** is scheduled for March 22 through April 6, 1952, at Navy Pier. Headquarters Merchandise Mart, Chicago 54, Ill.

**American Society of Tool Engineers** holds its 9th Bi-ennial Industrial Exposition in Chicago, March 17-21, 1952, at the International Amphi-theatre. ASTE headquarters 10700 Puritan Ave., Detroit 21, Mich.

**APRIL**

**American Society of Lubrication Engineers** holds its Seventh Annual Meeting and Lubrication Show at the Hotel Statler in Cleveland, Ohio, April 7-9, 1952.

**The National Industrial Service Association** will hold its annual convention at the Conrad Hilton Hotel (formerly the Stevens Hotel) in Chicago, Illinois, April 20-24, 1952. Further information from Assn. headquarters at 818 Olive St., St. Louis 1, Mo.

**MAY**

**Second Annual National Air Pollution Symposium** will be held May 5-6, 1952 at the Huntington Hotel, Pasadena, Calif. Details from A. M. Zarem, Chairman, Room 332, 612 South Flower St., Los Angeles.

# News
**of men and companies**

*( Continued from page 126 )*

**The Permutit Co.**—The industrial sales dept has named R. B. Bruns district engineer of its Philadelphia office. His former position as district engineer of the Decatur, Ill., office will be filled by M. Blundon.

**Republic Rubber Div.**—This div of the Lee Rubber & Tire Corp. promotes K. H. Dressel to field engineer, with headquarters in St. Louis. A. W. Crew has joined the company as a field engineer, with headquarters in Charleston, W. Va.

**Peerless Pump Div.**—This div of Food Machinery and Chemical Corp. announces appointment of R. F. Brisbois as process pump specialist.

K. H. Cree

R. F. Brisbois

**Western Precipitation Corp.**—The company's new offices in Atlanta, Ga., will be under the direction of K. H. Cree.

**Worthington Pump and Machinery Corp.**—H. Miller, one of the country's leading compressor authorities, recently retired after serving 50 years with Worthington. B. A. Bauer has been appointed purchasing agent and supvr of stores of the Oil City, Pa. plant.

## OBITUARIES

**Miller Electric Manufacturing Co.**—R. A. Metcalf, 42, sales mgr, died after a heart attack while shoveling snow at his home.

**The International Nickel Co., Inc.**—Dr. F. Clapp, 71, one of the founders of the Sea Horse Institute, died recently after several months of extended illness.

**The Weinman Pump Mfg. Co.**—H. A. Strom, 68, chief designing engineer, died January 20.

M. E. Leeds

**Leeds & Northrup Co.**—M. E. Leeds, 82, founder and chairman of the board died Feb. 8 at Lake Wales, Fla., after several weeks illness. He was the recipient of numerous awards for development of instruments and controls.


*Insist on the Genuine!*

**RIC-WIL**

**SECTIONAL TILE AND CAST IRON CONDUIT SYSTEMS**

Since 1910, Ric-wiL has been furnishing Sectional Conduit Systems for low cost, efficient protection of underground insulated pipe lines.

1 **Entire system** designed by expert engineers of long experience to meet every requirement for unusual tightness, permanent alignment, and long life.

2 **Pipe supports** designed for strength to carry the piping load.

3 **Insulation** furnished as specified or as recommended by Ric-wiL's outstanding staff of engineers.

4 **Delivery:** Any size or quantity promptly from large stocks.

***CHECK THE FOLLOWING EXCLUSIVE FEATURES:***

ONLY RIC-WIL has Loc-liP joint running along entire length of conduit, including bells—assuring a completely sealed, watertight joint.

ONLY RIC-WIL design has base drain with side shoulders which carry entire weight of piping independent of conduit.

**THERE IS A RIC-WIL SECTIONAL SYSTEM FOR EVERY GROUND CONDITION**

**STANDARD TILE CONDUIT**—for normal ground loads.

**SUPER-TILE CONDUIT**—with extra heavy walls, under roadways.

**CAST IRON CONDUIT**—for installation under or near railroad tracks.

**UNIVERSAL TILE CONDUIT**—with half tile arch, trapezoidal side blocks, and concrete foundation.

Don't make the mistake of accepting inferior, poorly-designed and rank imitations of the original Ric-wil Sectional Systems. Make sure you specify "RIC-WIL"—preproved by thousands of installations—and know that you are getting the BEST.

**RIC-WIL**
INSULATED PIPING SYSTEMS
UNDERGROUND OR OVERHEAD

WRITE FOR LATEST CATALOG SECTION 480-4A.

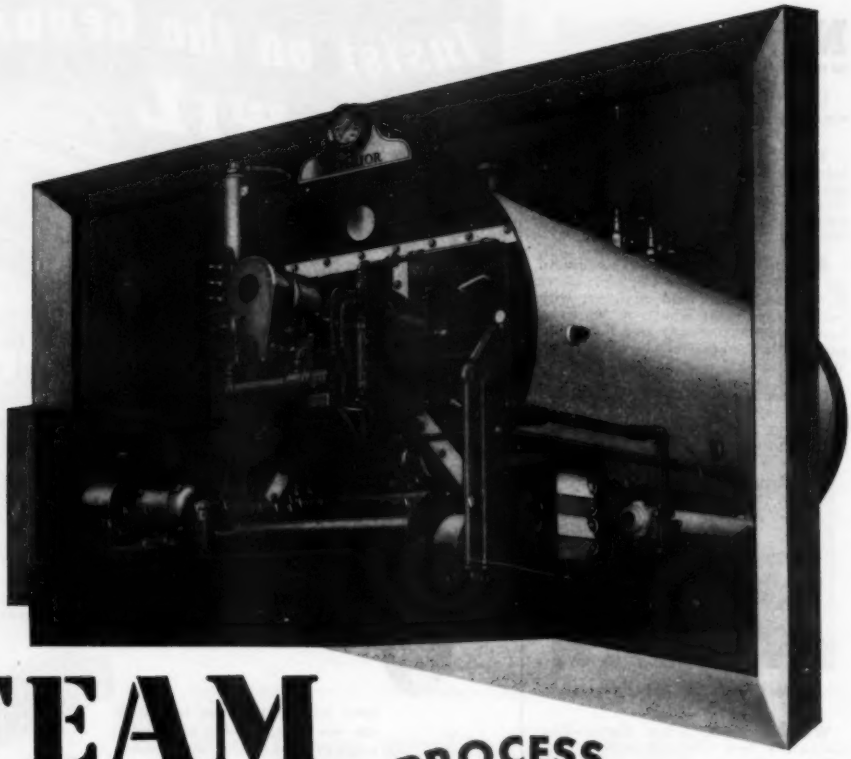
THE RIC-WIL COMPANY, CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES
LEADERS IN INSULATED PIPING PROTECTION

PREFABRICATED INSULATED PIPING

SECTIONAL CONDUIT SYSTEMS

PREFABRICATED MANHOLES

UTILIDOR TYPE CONDUITS



# STEAM
## FOR HEAT OR PROCESS

A complete steam plant whose heavy duty construction assures long-lived dependability throughout years of hard usage.

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides ample heating surface . . . at minimum, 5 sq. ft. b.h.p.
- Built-in induced draft fans provide added safety and eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Burner equipment to suit your fuel; gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.

*If you are planning new or additional steam facilities, you'll want Catalog 402 which tells all you should know about packaged steam plants.*

*for performance you can* **BANK** *on*

**SUPERIOR COMBUSTION INDUSTRIES INC.**
**TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.**

**SUPERIOR**
**STEAM GENERATORS**

**3** *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

# ENGINEERED PLANT SERVICES

**1. NEW EQUIPMENT**

Begins on page 8

Contains highlights of new products by leading manufacturers, briefed and illustrated for your easy reference. Complete data on each of these products are available ***free.***

**2. NEW BULLETINS**

Begins on page 148

Includes descriptions of only those bulletins and catalogs that are really ***new*** and of ***direct value*** to you — saves your reading time, yet gives you full service. All bulletins sent to you ***free*** on request.

**3. READERS GUIDE TO ADVERTISED PRODUCTS**

Begins on page 133

Designed to catalog advertised products for your convenience in finding the ads which are of special interest to you at this time. Also lists those important bulletins, catalogs and working data offered ***free*** in the advertisements.

**REQUEST CARD FOR LITERATURE OR MORE INFORMATION—March, 1952**

To: INDUSTRY AND POWER, St. Joseph, Mich. Please have forwarded to me, at no obligation, the literature I've indicated by the following key numbers:

| *New Equipment begins Page 8* | *New Bulletins begins Page 148* | *Advertised Products begins Page 133* |
|---|---|---|
| No's | No's | No's |
| | | |
| | | |
| | | |

**Your Name** _____ **Title** _____

**Your Company** _____

**Co. Address (St. & No.)** _____

**City** _____ **State** _____

Inquiries for items listed in this issue not serviced beyond July 1, 1952

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

**BUSINESS REPLY CARD**
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

3¢—POSTAGE WILL BE PAID BY

**INDUSTRY AND POWER**

420 MAIN STREET

ST. JOSEPH, MICH.

# 3 special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in

# ENGINEERED PLANT SERVICES

**1. NEW EQUIPMENT**

Begins on page 8

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FIRST CLASS
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**BUSINESS REPLY CARD**
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

**3¢—POSTAGE WILL BE PAID BY**

**INDUSTRY AND POWER**
**420 MAIN STREET**
**ST. JOSEPH, MICH.**

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|---|---|---|
| No.'s | No.'s | No.'s |
| | | |
| | | |
| | | |

Your Name _____ Title _____

Your Company _____

Co. Address (St. & No.) _____

City _____ State _____

Inquiries for items listed in this issue not serviced beyond July 1, 1952

# Readers' guide to advertised products

***This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly—or list paragraph key numbers on reader service card (page 131) to get data you want***

### AIR & DUST FILTERS & COLLECTORS

***Mikro-Collector*** **500**

Free sample of felt used in Mikro-Collector for collection of radioactive dusts. Pulverizing Machinery Co. Adv. page 150.

***Dust Collectors*** **501**

Catalog 601 gives complete details on Aerotec dust collection. The Thermix Corporation. Adv. page 32.

***Dust Collectors*** **502**

Bulletin 163-5 describes Norblo portable dust collecting units. The Northern Blower Co. Adv. page 50.

***Electrical Precipitator*** **503**

Bulletin 500 contains information on the Research Corp. Cottrell Precipitator. Research Corp. Adv. page 44.

***Fume Control Systems*** **504**

Literature available on fume control systems. The Kirk & Blum Mfg. Co. Adv. page 123.

***Precipitator*** **505**

Literature describes the advantages of combination mechanical and electrical Multiclone-Cottrell Precipitator. Western Precipitation Corp. Adv. page 127.

### ANTI-CORROSIVE & PROTECTIVE COATINGS

***Rust Preventive*** **506**

Adv. page 61 contains coupon for complete information on Rust-Oleum sealing compound. Rust-Oleum Corp.

### BOILERS & BOILER ACCESSORIES

***Boilers*** **507**

Complete information on Erie City boilers. Erie City Iron Works. Adv. page 111.

***Boiler*** **508**

Descriptive literature available on Wickes Type-A Dowtherm Vaporizer. The Wickes Boiler Co. Adv. page 27.

***Continuous Blowdown Equipment*** **509**

Free blowdown chart available on Henszey packet-type automatic continuous blowdown. Henszey Co. Adv. page 157.

***Boiler Trim*** **510**

Catalog No. 700 contains complete information on boiler trim. Wright-Austin Co. Adv. page 29.

***Water Gages*** **511**

New or installed Yarway flat glass gages may be equipped with Type "M" illuminator that shines like a star—Bulletin WG-1811. Yarnall-Waring Co. Adv. page 57.

### BUILDING HEATING, VENTILATING, AIR CONDITIONING & REFRIGERATION

***Air Conditioning*** **512**

Information on Trane heating, cooling, ventilating, and air conditioning. The Trane Co. Adv. page 53.

***Air Handling Equipment*** **513**

Information on heating, cooling, drying, air conditioning and air handling equipment. American Blower Corp. Adv. page 54.

***Air Handling & Conditioning Equip.*** **514**

Advertisement contains branch headquarters in 54 cities for Clarage air handling and conditioning equipment. Clarage Fan Co. Adv. page 4.

### BUILDING MATERIALS & MAINTENANCE

***Vacuum Cleaning Equipment*** **515**

Complete data on Hoffman heavy-duty vacuum cleaning equipment. U. S. Hoffman Machinery Corp. Adv. page 114.

***Steel Grating*** **516**

Bulletin 2365 describes Blaw-Knox electroforged steel grating and stair treads. Blaw-Knox Div. of Blaw-Knox Co. Adv. page 146.

***Thread Compound*** **517**

Free sample and data sheet on Fel-Pro C-5 "Hi-Temp" Thread Compound. Felt Products Mfg. Co. Adv. page 152.

***Iron Cement*** **518**

Free Repair Handbook describes Smooth-On repairs. Smooth-On Mfg. Co. Adv. page 156.

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### COAL, ASH & BULK HANDLING

**Belt Conveyors** 519
Advertisement gives information on Link-Belt conveyers. Link-Belt Co. Adv. page 3.

**Coal & Ash Handling Machinery** 520
Information on complete line of material handling, processing and mining equipment. The Jeffrey Mfg. Co. Adv. page 41.

**Coal** 521
Information on Bell & Zoller coals. Bell & Zoller Coal Co. Adv. page 40.

**Car Shakeout** 522
Bulletin 128-A gives complete facts on Hewitt-Robins car shakeout. Hewitt-Robins Inc., Robins Conveyors Div. Adv. page 153.

**Vibratory Feeders** 523
Catalog contains data on Syntron Vibratory Feeders. Syntron Co. Adv. page 142.

**Skip Hoists** 524
One of many G-W systems of materials handling. Gifford-Wood Co. Adv. page 121.

### CONTROLS, REGULATORS & INSTRUMENTS

**Thermometers** 525
Free Bulletin AA50 describes Weksler adjust-angle industrial thermometers. Weksler Thermometer Corp. Adv. page 159.

**Regulators** 526
Bulletin 50-1000 gives details on patented Stacon regulator. Farris Stacon Corp. Adv. page 140.

**Tank Gage** 527
Complete details on Liquidometer tank gage. The Liquidometer Corp. Adv. page 162.

**Combustion Guide Instruments** 528
Complete information available on Hays combustion guide instruments. The Hays Corp. Adv. page 42.

**Regulators** 529
Bulletin 350 gives complete details on Spence's line of automatic regulating valves. Spence Engineering Co., Inc. Adv. page 46.

**Thermometers** 530
Catalog shows the many styles and types of Auto-Lite Thermometers. The Electric Auto-Lite Co. Adv. page 147.

### CRANES, HOISTS & CAR PULLERS

**Handling Equipment** 531
Bulletins 79 and 64A describe SH Krane Kar and Car Pullers. Silent Hoist & Crane Co. Adv. page 146.

### DIESELS

**Diesel Engines** 532
Complete information on Chicago Pneumatic diesel engines. Chicago Pneumatic Tool Co. Adv. page 109.

### ELECTRICAL DISTRIBUTION

**Mechanical Rectifiers** 533
I-T-E Mechanical Rectifiers are described in Bulletin 5106. I-T-E Circuit Breaker Co. Adv. pages 112, 113.

**Fuses** 534
Complete facts about Fusetron dual-element fuses. Bussman Mfg. Co. Adv. pages 30, 31.

**Switchgear** 535
Catalog Section 7004 and Bulletin 7000-A contain information, selection and application data on I-T-E Metal-clad Switchgear. I-T-E Circuit Breaker Co. Adv. pages 100, 101.

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**Brickwork in Furnace and Boiler Linings, Settings, Floors, Doors, Arches, Baffles, Jambs**

**√ Sets Harder — √ Bonds Stronger**
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Super #3000 is a ready mixed, plastic refractory mortar for laying new refractories, patching, or wash-coating refractories for added protection.

Made to withstand any working temperature to 3000° F., flame erosion and abrasion, Super #3000 is matchless for adhesiveness and durability. It does not crack or break, and definitely reduces spalling, outlasting any other bonding refractory cement 3 to 1.

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Offices in Chicago — Philadelphia — Cleveland — Newark, N. J.

***Armor Cables*** **536**

Booklet 19-320 gives complete details on G-E interlocked armor cable. General Electric Co., Construction Materials Div. Adv. page 35.

***Magnetic Starters*** **537**

Illustrated bulletins on Type "RA" magnetic starters. The Arrow-Hart & Hegeman Electric Co. Adv. page 135.

***Fuses*** **538**

Price list and catalog on "Economy De-Lay" Renewable Fuses. Economy Fuse and Mfg. Co. Adv. page 60.

***Motor Switches*** **539**

Bulletins 1010 and 1410 contain information on Heinemann motor switches. Heinemann Electric Co. Adv. page 163.

**FANS & BLOWERS**

***Fans*** **540**

Catalog 200 gives complete information on Prat-Daniel fan stacks. The Thermix Corporation. Adv. page 126.

***Exhaust Fan*** **541**

Information on Gallaher Air Van power exhauster for expelling moisture and fumes. The Gallaher Co. Adv. page 162.

**FILTERS, STRAINERS & PURIFIERS**

***Flo-Klean Strainers*** **542**

Information on Cuno Flo-Klean Strainers. Cuno Engineering Corp. Adv. page 15.

**FUELS & FIRING EQUIPMENT**

**Coal** **543**

Complete data on Southern's engineered industrial coal. Southern Coal Company, Inc. Adv. page 58.

**Stokers** **544**

Complete line of underfeed and spreader stokers for use with any boiler. Vestinghouse Electric Corp. Adv. page 45.

**LP-Gas** **545**

Estimate available on Pritchard LP-gas standby plant engineered to your specific requirements. J. F. Pritchard & Co. Adv. page 116.

**Coal** **546**

Full information on bituminous coal. Bituminous Coal Institute. Adv. page 37.

***Burners*** **547**

Coupon offers complete data on Coppus-Dennis Fanmix Burners. Coppus Engineering Corp. Adv. pages 24, 25.

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**REPLACE TODAY WITH TOMORROW'S STARTER**

**TYPE "RA" MAGNETIC STARTERS ARE AN INVESTMENT IN ADVANCED DESIGN**

***Because*** **. . the revolutionary "RA" balanced operating mechanism . . .**

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- saves up to 30% on time, work and space
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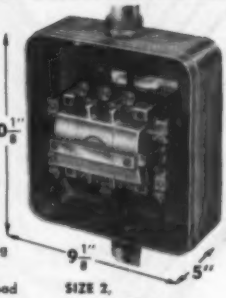


SIZE 2, NEMA TYPE I

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**THERE'S AN "RA" STARTER FOR EVERY JOB**

**Sizes 0-1-2-3-4 are available in NEMA Type I,IV,V,VII and IX enclosures. EXPLO-SAFE, the explosionproof version of the "RA" starter line, brings greater safety and improved performance with new compactness to all hazardous location installations.**

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**Send today for your copies of these fully illustrated bulletins — Size 4 Type "RA" Magnetic Starters, Explo-Safe Motor Controls and Multi-Speed Starters and Reversing Starters. They contain complete engineering data with ratings and dimensions on the entire "RA" Starter line.**

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**ARROW·HART**

**INDUSTRIAL CONTROL DIVISION**

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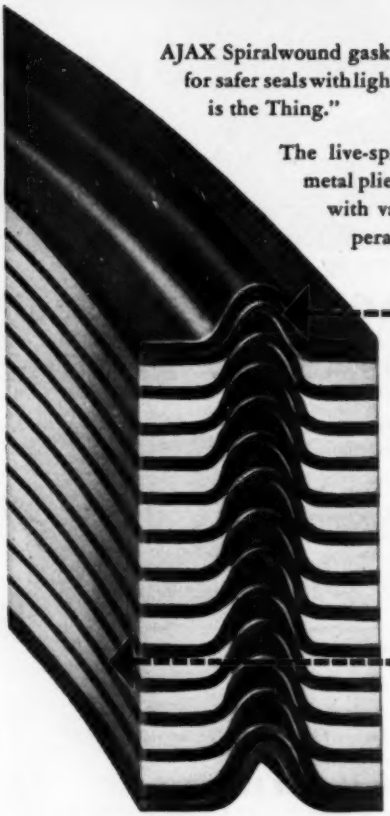

AJAX Spiralwound gaskets have built in resilience for safer seals with lighter bolt-loads. "The Spring is the Thing."

The live-spring action of U-shaped metal plies lets this gasket "Breathe" with varying pressures and temperatures.

Multiple knife edges bite into flange surfaces. Each ply is a separate seal.

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Materials of construction meet all gasket requirements. Metals are plated low-carbon steel or stainless. Fillers are Canadian or Blue African asbestos or chemically inert TEFLON.* Sold universally through Industrial Distributors. Ask your Mill Supply House or write

*du Pont's trademark for its tetrafluoroethylene resin.

UNITED STATES GASKET COMPANY

670 N. 10TH STREET, CAMDEN, N.J.

LEADING FABRICATORS OF "TEFLON" FOR THE CHEMICAL, PROCESS AND ELECTRONIC INDUSTRIES


## Readers' guide to advertised products

*( Continued from page 135 )*

### HEAT EXCHANGER EQUIPMENT

***Heat Exchanger*** **548**
Bulletin 120 gives complete information on Niagara evaporative heat exchangers and water coolers. Niagara Blower Co. Adv. page 151.

***Deaerators*** **549**
Information on deaerating heaters and deaerators. Worthington Pump and Machinery Corp, Water Treating Div. Adv. page 59.

### LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

***Lubricant*** **550**
Information available on Standard HD Oil. Standard Oil Co. (Indiana). Adv. page 49.

***Lubricant*** **551**
Information on Texaco Regal Oil. The Texas Co. Adv. page 166.

***Lubricant*** **552**
Kano Kroil softens rust, dissolves gum and supplies lubrication to loosen parts. Kano Laboratories. Adv. page 140.

***Lubricant*** **553**
Bulletin 550 and free testing sample of "NR" grade Non-Fluid Oil for all pneumatic tools. New York & New Jersey Lubricant Co. Adv. page 138.

### MECHANICAL POWER TRANSMISSION

***V-Belts*** **554**
Complete information on Dayton Cog-Belts and Thorobred V-Belts. Dayton Rubber Co. Adv. page 65.

***QD Sheaves*** **555**
Bulletin V-1400-B7F describes Worthington QD sheaves. Worthington Pump & Machy. Corp., Multi-V-Drive Sales Div. Adv. page 38.

***Roller Chains*** **556**
Roller chain fact book No. ARC-521P describes Atlas roller chain. Atlas Chain & Mfg. Co. Adv. page 48.

***V-Belts*** **557**
Advertisement gives information on Goodrich Grommet Belts. B. F. Goodrich Co. Adv. pages 19, 20, 21, and 22.

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**V-Belts** **558**

Information on Gates Vulco Ropes. The Gates Rubber Co. Adv. page 43.

**Condor V-Belts** **559**

Bulletin 6868-E "Grips the Grooves" contains data on R/M Condor V-belts. Raybestos-Manhattan, Inc. Manhattan Rubber Div. Adv. page 102.

**Variable Speed Pulleys** **560**

Complete catalog & engineering data on Lovejoy variable speed pulleys. Lovejoy Flexible Coupling Co. Adv. page 122.

## PACKAGED STEAM GENERATORS

**Packaged Steam Boilers** **561**

Fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog. Cleaver-Brooks Co. Adv. page 119.

**Steam Generators** **562**

Catalog 402 contains complete data on Superior packaged steam generators. Superior Combustion Industries Inc. Adv. page 130.

**Generators** **563**

Bull. 175 describes Preferred horizontal rotary oil burner, and Bull. 1000 describes Preferred unit steam generator. Preferred Utilities Mfg. Corp. Adv., page 63.

**Generators** **564**

Catalog contains information on Clayton Forced Recirculation Generators. Clayton Mfg. Co. Adv. page 34.

**Generator** **565**

Bulletin 1101-C describes the Amesteam generator. Ames Iron Works. Adv. page 145.

**Generator** **566**

Bulletin 1218 contains complete details on the Powermaster steam generator. Orr & Sembower, Inc. Adv. page 105.

## PACKING AND GASKETS

**Packing** **567**

Catalog PC-101 gives complete information on Palmetto Palco. Greene, Tweed & Co. Adv. page 157.

**Gaskets** **568**

Information on Ajax Spiralwound gaskets. United States Gasket Co. Adv. page 136.

**Packings & Gaskets** **569**

Information on R/M packings and gaskets. Raybestos-Manhattan, Inc., Packing Div. Adv. page 56.

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**when you want tools fast**

**....Phone your nearby Snap-on factory branch**

● You'll talk to a *tool man* when you get your Snap-on branch on the wire. He'll understand your wants clearly, and help you select the most efficient tools for your needs. You'll get professional tools of the finest character — properly designed, strong, versatile, *safe,* Snap-on Tools—that will serve you long and well. For 30 years, plants—large and small—have used and endorsed this "time-saving way to buy time-saving tools." May we send you copies of the latest Snap-on Industrial and General Catalogs? Write—

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**8102-C 28th Ave., Kenosha, Wis.**

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**Chicago 16, Ill.,** 2023 Michigan Ave.
**Cincinnati 6, Ohio,** 705 E. McMillan St.
**Cleveland 15, Ohio,** 2912 Euclid Ave.
**Dallas 1, Texas,** 2932 Commerce St.
**Denver 3, Colo.,** 1050 Broadway
**Detroit 2, Mich.,** 93 Piquette Ave.
**Edmonton, Alberta,** 10232 103rd St.
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**Houston 3, Texas,** 1810 LaBranch St.
**Indianapolis 2, Ind.,** 848 Fort Wayne Ave.
**Jacksonville 6, Fla.,** 1602 Walnut St.
**Kansas City 2, Mo.,** 3635 Main St.
**London, Ontario,** 111 Mt. Pleasant Ave.
**Los Angeles 14, Calif.,** 1717 W. 6th St.
**Milwaukee 3, Wis.,** 2600 W. State St.
**Minneapolis 3, Minn.,** 1218 Hennon Place
**Montreal 15, Quebec,** 751 Jean Talon St., West
**Newark 6, N. J.,** 823 Sandford Ave.
**New Orleans 13, La.,** 1040 Camp St.
**New York 56, N. Y.,** 397 East 167th St.
**Oklahoma City 3, Okla.,** 901 N. Hudson St.
**Omaha 2, Nebr.,** 109 S. 24th St.
**Philadelphia 30, Pa.,** 1710 Fairmount Ave.
**Pittsburgh 8, Pa.,** 7007 Kelly St.
**Regina, Sask.,** 2070 Albert St.
**Richmond 20, Va.,** 1617 West Broad St.
**San Francisco 2, Calif.,** 635 Golden Gate Ave.
**Seattle 22, Wash.,** 1501 Olive Way
**St. Louis 3, Mo.,** 2647 Washington Blvd.
**Syracuse 3, N. Y.,** 323 Irving Ave.
**Toledo 6, Ohio,** 2932 Monroe St.
**Toronto 17, Ont.,** 130 Laird Drive
**Vancouver, B. C.,** 1043 Davie St.
**Winnipeg, Manitoba,** 238 Garry St.

***Foremost* IN HAND TOOL ENGINEERING, MANUFACTURE, DISTRIBUTION**

# what do you want in your valves

**AUTOMATIC CONTROL?**

for quick opening and shut-off by motor, air operator, air or hydraulic cylinder or positioning for any desired flow rate? You can get it with Rockwell Butterfly Valves.

**RESISTANT CONSTRUCTION?**

of cast iron and steel, stainless steel, bronze, Hastelloy, or rubber-lined to withstand chemical or abrasive action? You can have it in Rockwell Butterfly Valves.

**DEPENDABLE OPERATION AT ANY TEMPERATURE OR PRESSURE?**

of air, gases, liquids and semi-solids at temperatures below freezing or as high as 1600°F, at pressures to 100 p.s.i.g. without clogging or breakdown? You can be sure—if you install Rockwell Butterfly Valves. Pipe sizes—1" to 4" threaded; 4" to 72" flanged or wafer type.

*Rubber-lined steel, heavy duty valve for 90 p.s.i. — with air cylinder operator, clutch and auxiliary handwheel control.*

*Write for Catalog and the monthly "Valve News"*

**ROCKWELL VALVES**

W. S. ROCKWELL CO. • 230 Eliot St., Fairfield, Conn.

# NON-FLUID OIL

TRADE MARK REGISTERED

## Stays In Shake-Out Bearings

Super-adhesive F-2925 and S-258-M grades of NON-FLUID OIL are designed to withstand violent shocks and terrific vibration of shake-outs and screens. NON-FLUID OIL, through its exclusive adhesive properties, stays in ball and roller bearings and protects against friction long after ordinary greases have been "knocked out" or become "dead".

Send for testing samples of F-2925 and S-258-M grades of NON-FLUID OIL and prove to yourself that they will stay in shake-outs and will remain "alive" longer, outlasting ordinary greases 3 to 5 times.

**NEW YORK & NEW JERSEY LUBRICANT COMPANY**

292 Madison Avenue, New York 17, N. Y.
Plant: Newark, N. J.

*Represented in principal industrial centers.*

Why not also write for new Bulletin 550 and free testing sample of "NR" grade NON-FLUID OIL especially manufactured for all pneumatic tools.

*NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture*


## Readers' guide to advertised products

*( Continued from page 137 )*

***Packings*** **570**
Tips on how to make packings last longer. Johns-Manville Corp. Adv. page 143.

### PIPE AND FITTINGS

***Insulated Piping*** **571**
Catalog Section 480-4A contains data on Ric-wiL insulated piping systems. The Ric-wiL Company. Adv. page 129.

***Revolving Joints*** **572**
Bulletin 300 contains complete information on Type IBR revolving joints. Barco Mfg. Co. Adv. page 155.

***Flexible Metal Hose*** **573**
Catalog 500 gives details on Atlantic seamless or interlocking hose in bronze, steel and stainless steel. Atlantic Metal Hose Co., Inc. Adv. page 160.

***Flexible Metal Hose*** **574**
Bulletins SS-50 and CC-300 contain data on American flexible metal hose and tubing. The American Brass Co., American Metal Hose Branch. Adv. page 62.

### PUMPS

***Hydraulic Descaling*** **575**
Information on descaling hydraulically with BJ hydropress pumps. Byron Jackson Co. Adv. page 51.

***Pumps*** **576**
Information on Marlow plunger sludge pumps. Marlow Pumps. Adv. page 139.

***Pumps*** **577**
Information available on Weinman pumps. The Weinman Pump Mfg. Co., Adv. page 110.

### REFRACTORY CONCRETES

***Refractory Cement*** **578**
Bulletin R-53 describes Super 3000 Refractory Cement. Refractory & Insulation Corp. Adv. page 134.

***Refractory Concrete*** **579**
Bulletin R-22 contains data on B&W Kaocast. The Babcock & Wilcox Co., Refractories Div. Adv. page 107.

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***Industrial Concrete*** **580**

Free booklet on many uses of Lumnite for industrial concretes. Lumnite Div., Universal Atlas Cement Co. Adv. page 64.

**SOOT BLOWERS & TUBE CLEANERS**

***Tube Cleaners & Expanders*** **581**

Full details on Airetool tube cleaners and expanders. Airetool Mfg. Co. Adv. page 149.

***Tube Cleaners*** **582**

Complete details on Rotojet tube cleaners. Elliott Company — Roto Division. Adv. page 141.

**STEAM SPECIALTIES**

***Steam Specialties*** **583**

Full details on strainers, traps and external discharge valves. The Clark Mfg. Co. Adv. page 124.

***Traps & Strainers*** **584**

24-page Yarway Steam Trap Catalog describes Yarway traps and strainers. Yarnall-Waring Co. Adv. page 66.

***Traps*** **585**

Free manual "Steam Hook-ups" contains data and selection chart on Sarco steam traps. Sarco Co., Inc. Adv. page 52.

***Traps*** **586**

New available Armstrong Steam Trap Book (Catalog J). Armstrong Machine Works. Adv. page 2.

***Traps*** **587**

Catalog 751 (or see Sweet's) tells all about freeze-proof steam traps. W. H. Nicholson & Co. Adv. page 144.

**TOOLS**

***Snap-On Tools*** **588**

Industrial and General Catalogs describe Snap-on Tools. Snap-On Tools Corp. Adv. page 137.

***Valve and Bibb Reseater*** **589**

See advertisement for data on Skinner valve and bibb reseater. M. B. Skinner Co. Adv. page 147.

***Pipe Tools*** **590**

Catalog with data on complete line of Toledo pipe tools and power pipe threading machines. The Toledo Pipe Threading Machine Co. Adv. page 36.

***Tools*** **591**

Send 10c for 68-page catalog of Proto Tools. Plomb Tool Co. Adv. page 6.

***Blower Suction Cleaner*** **592**

Clements-Cadillac portable blower-

***( Continued on page 140 )***

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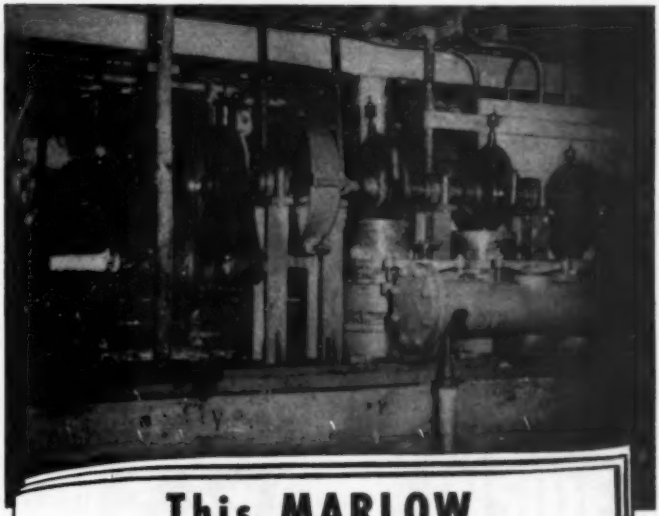
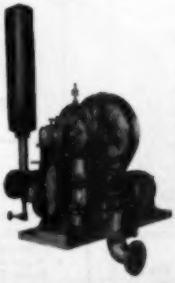


# This MARLOW Plunger Sludge Pump Makes Paper "Flow" Smoothly

**The Marlow Triplex above is moving semi-chemical neutral sulphite pulp from a stock chest to the beaters. The installation is at Watervliet Paper Co., Watervliet, Michigan.**

**Two other Marlow Plunger Sludge Pumps handle the long fibre pulp easily and steadily to keep the machine chests at required levels. One of these handles bleached sulphite from the bleach washer to a storage chest. The second pumps deinked and bleached waste paper from a bleach washer to a storage chest.**

**Marlow Plunger Sludge Pumps have a reputation for doing a beautiful job on bulky, thick, usually troublesome pumpage. They are consistently solving some of industry's most perplexing problems.**



**In your own industry, if you are concerned with heavy sluggish pumping of any kind, find out about the efficiency and durability of Marlow Plunger Sludge Pumps. And for your other pumping needs ask also about the famous Marlow Self-Priming Centrifugal Pumps — Portable and stationary models — and Marlow Portable Diaphragm Pumps.**

***Write today for name of dealer nearest you.***

**MARLOW PUMPS** 515 GREENWOOD AVENUE RIDGEWOOD, NEW JERSEY

*Manufacturers of the World's Finest Industrial Pumps*

## Readers' guide to advertised products

*( Continued from page 139 )*

suction cleaner. Clements Mfg. Co. Adv. page 159.

### TRANSFORMERS

**Transformers** **593**

Bulletin AC185 contains data on the application of dry type transformers. Acme Electric Corp. Adv. page 156.

### TURBINES

**Turbines** **594**

Information on Worthington steam turbines. Worthington Pump & Machy. Corp., Steam Turbine Div. Adv. page 117.

**Turbines** **595**

Information on Westinghouse General-Purpose Turbines. Westinghouse Electric Corp. Adv. page 33.

**Turbines** **596**

Bulletin 03B7654 contains complete details on WA-Series steam turbine generator unit. Allis-Chalmers. Adv. pages 10, 11.

**Turbines** **597**

Bulletin S-116 contains information on the Terry Solid-wheel Turbine. The Terry Steam Turbine Co. Adv. page 106.

### VALVES

**Valves** **598**

Catalog 20 contains data on Chapman cast steel gate, globe and check valves. The Chapman Valve Mfg. Co. Adv. page 118.

**Valves** **599**

Advertisement describes Jenkins Fig. 106-A series valve. Jenkins Bros. Adv. page 9.

**Valves** **600**

Coupon offers Atlas regulating valve Bull. No. 1-A and also data on other Atlas products. Atlas Valve Co. Adv. page 154.

**Valves** **601**

Information on all types of Edward cast and forged steel valves. Edward Valves, Inc. Adv. pages 14, 15.

**HOW TO REQUEST FREE LITERATURE**

Insert "key" numbers on return post card found on page 131. For quick reference to free literature offered by advertisers in this issue, refer to listing on page 142. Our Reader's Service Department will handle your request promptly.

**Valves** **602**

Information on Aloyco bolted bonnet types Y valves. Alloy Steel Products Co., Inc. Adv. pages 47.

**Valves** **603**

Information on the complete Vogt line of drop forged steel valves, fittings and flanges. Henry Vogt Machine Co. Adv. page 39.

**Valves** **604**

Information on Crane No. 1611 iron body packless diaphragm valves. Crane Co. Adv. page 7.

**Valves** **605**

Catalog and "The Valve News" describe Rockwell valves. W. S. Rockwell Co. Adv. page 138.

**Diaphragm Valves** **606**

Bulletin 513 describes Leslie Double Seated Diaphragm Valves. Leslie Co. Adv. page 125.

**Silent Check Valves** **607**

Bulletin WH 851 contains data on water hammer, its cause, effect & control in piping systems. The Williams Gauge Co. Adv. page 128.

**Valves** **608**

Catalog gives 4 ways to cut pump repairs. Sims Pump Valve Co., Inc. Adv. page 163.


THIS SQUIRT LOOSENS-

FROZEN BOLTS..BEARINGS

It's fast and accurate—shoots 15 feet—a drop or a squirt. It's labeled Kroil—so you can grab it quickly when a frozen bolt, screw or bearing starts to cost expensive time or threaten production.

That is when Kroil creeps into millionth inch spaces to soften rust, dissolve gum and supply lubrication to loosen the parts. It's fast and it's positive.

"Kano Kroil always opens up the tight fitting covers on fire extinguishers for us. It is truly a wonderful preparation. We have found such covers we could not force off with a blow of a hammer. Several minutes' seepage of Kroil did the trick," so says a service organization for fire extinguishers.

Krollers are priced at $1.50 each and are well worth it. As an inducement to try Kroil we offer the combination of one Kroiler and one gallon of Kroil—(listed at $3.50) for $4.75, f.o.b. factory.

If you are not one of the 9500 industrial plants already using Kroil, send for a gallon on the proposition that it will loosen the most stubborn frozen part or you get your money back.

**KANO LABORATORIES**

1085 Thompson Lane • Nashville 11, Tenn.

Before you select a Temperature Regulator, compare low-cost Stacon with the rest. No other regulator has as many features or offers as many advantages as a Farris Stacon.

**PROVE IT!**

*Make this Chekchart Test*

| | Farris Stacon | Air Operated | Self Operated |
|---|---|---|---|
| • Dirt Proof — Hermetically Sealed? | Yes | | |
| • Extreme Accuracy? | ±1° | | |
| • Packing or Glands to Leak? | No | | |
| • Drop-tight Shut off? | Yes | | |
| • Vapor-stream Energized Super Power Pilot? | Yes | | |
| • Supervision—Maintenance? | None | | |

Write for Stacon Bulletin 50-1000. It contains complete information on the most sensitive, accurate, economical temperature regulator available . . . anywhere.

**Farris Stacon Corp.**

533 COMMERCIAL AVE. PALISADES PARK, N. J.

## WATER TREATMENT

**Waste Treatment** 609

Free copy of "Reference Bibliography for Water, Sewage and Power Plant Engineering." Gilbert Associates, Inc. Adv. page 165.

**Water Treatment** 610

Free data sheet available on Bird-Archer's Concentrol Anti-foam. Bird-Archer Co. Adv. page 28.

**Water Treatment** 611

Bulletin 5000 describes Dearborn's industrial water treatment. Dearborn Chemical Co. Adv. page 55.

**Water Treatment** 612

Advertisement lists 63 available bulletins, articles and reprints on the Nalco system of water treatment. National Aluminate Corp. Adv. page 13.

**Water Conditioning** 613

Technical Paper No. 124 contains full facts on Betz water conditioning service. W. H. & L. D. Betz. Adv. page 17.

**Water Treatment** 614

New catalog shows all Penfield water-treating equipment. Penfield Manufacturing Co., Inc. Adv. page 158.

**Water Plants** 615

Bulletin available on the water plant your company needs. Hungerford & Terry, Inc. Adv. page 152.


this sword means Cancer RESEARCH

For millions cancer research is a race for life.

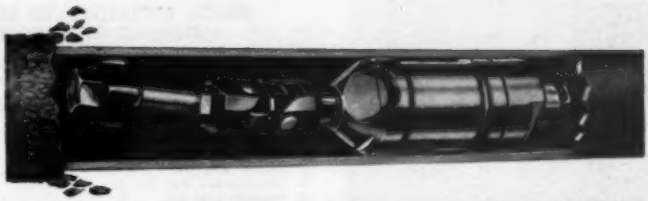
The American Cancer Society supports research in 100 institutions in 35 states . . . grants aid to 900 investigators . . . trains as fellows 78 young men and women.

However, some vital research has been retarded because of lack of funds . . . twice as many dollars could be used in 1952 under the sign of the cancer sword. Cancer Strikes One in Five. Your Dollars Strike Back.

*Mail Your Gift to "Cancer" Care of Your Local Postoffice*

**AMERICAN CANCER SOCIETY**





# ROTOJET®

## Cleans Fire Tubes ▸▸▸▸▸▸ FAST ▸▸▸▸▸▸▸

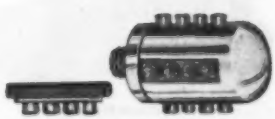
INSIDE *and* OUTSIDE

**You can now clean fire tubes inside as well as outside faster with a new Rotojet. The new Rotojet is the most powerful tube cleaner we ever built. It won't stall at low speeds caused by heavy loads. Roto expanding heads and brushes thoroughly clean soot scale inside tubes. A Roto vibrating head (illustrated above) knocks off water scale adhering on the outside.**

**Try the new Rotojet, and no other tube cleaner will ever satisfy you.**

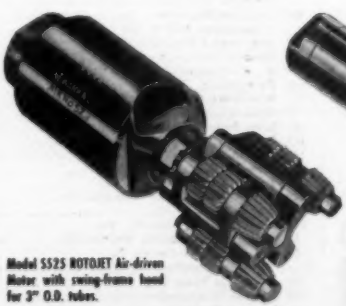
### Economical Roto Brushes

**Roto expanding brushes and heads have separately replaceable wearing elements. These inexpensive parts save time, money, and critical materials. Send for details.**



Roto expanding brush, showing a replaceable brush element. Brings down tube cleaning cost. Maintains high cleaning efficiency

Roto solid wire brush.



Model SS2S ROTOJET Air-driven Motor with swing-frame head for 3" O.D. tubes.

Model SS0S ROTOJET Air-driven Motor with 2-arm head for 2" O.D. tubes.

**ELLIOTT COMPANY-ROTO DIVISION**
**156 Sussex Avenue Newark 1, N. J.**

Two model F-22 Syntron Feeders feeding coal from track hopper to conveyor belt in a Power Plant. These Feeders, in this particular installations, handle a carload of coal as fast as 20 minutes.

**Fill Your Need For**
**Heavy Tonnage**
**Coal Handling to**

**Crushers, Screens, Conveyor Belts, Driers, Mullers, etc., with**

*SYNTRON*

*"Vibra-Flow"*

**VIBRATORY FEEDERS**

Capacities of up to
Hundreds of Tons Per Hour
At Instantly
Controllable Rates
of Material Flow

Finger-tip dial control of rate of flow is standard on all models

Write Today
For FREE Catalog
Folder
**SYNTRON VIBRATORY FEEDERS**

**SYNTRON CO.**
425 Lexington Ave. Homer City, Pa.


## QUICK REFERENCE TO BULLETINS AND CATALOGS OFFERED BY ADVERTISERS IN THIS ISSUE

***Following is an alphabetical listing of those advertisers offering free literature in their advertisements. To obtain your copies, all you need do is to list the "Key Numbers" for literature desired on the yellow postal card on page 131***

| Page No. | Advertiser | Catalog | Key No. |
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| 62 | American Brass Co., American Metal Hose Branch | Flexible Metal Hose | 570 |
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# How to make packings last longer

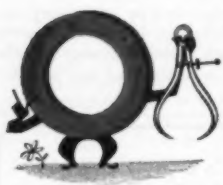
**Tips by Johns-Manville Engineers to help you keep production rolling**

## Correct installation cures many packing troubles

### Danger! Don't mix me with old packings

Old packings may look all right, but often they are so dry and highly compressed that they may cause scoring. Play it safe and remove *all* old packing before putting new packing in place. Be sure to remove accumulations from stuffing box walls, gland follower and shaft. New packing is cheaper than new rods, shafts and sleeves!

### Make sure I'm the right size



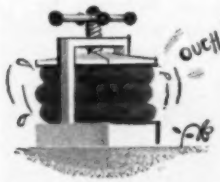
Packing that's too small may turn with the shaft. Oversize packing may cause excessive pressure and subsequent scoring. To find the correct size, check the rod or shaft diameter and the inside diameter of the stuffing box—then choose a packing to fit. In this way, allowance is automatically made for wear of the rod.

### Seat me one ring at a time

Never load the stuffing box with packing rings and try to seat them all at once by tightening the gland follower. This invites trouble due to excessive gland pressure. Always install one ring at a time, making sure it's properly seated *before* the next ring is installed.

### Don't squeeze me too tight!

Too much gland pressure is a common cause of packing failures. After the packing is installed, pull up the follower only sufficiently tight to insure seating of the last rings installed. Then back it off, leaving the nuts finger-tight. Don't worry about a little leakage. Actually, it's good assurance that the packing isn't too tight in the stuffing box. Besides, the liquid frequently has some lubricating qualities.




*Why you can expect longer life from*

### NAVALON Style No. 190

**Made from specially processed ramie—nature's strongest fiber—Navalon stands up in severe service where other cold-liquid packings fail. It gives outstanding performance in pumps, elevators, accumulators, presses, and on reciprocating rods and plungers operating against fresh or salt water, brine, cold oil and many other liquids.**

**Your distributor will help, too!** Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

## Johns-Manville PACKINGS & GASKETS

# Spot news

( Continued from page T16 )

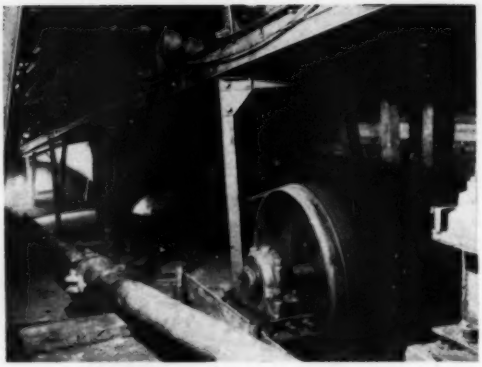
## B&W Places New Hot Extrusion Facilities in Operation

Seamless stainless steel tubing is being produced on the new hot extrusion facilities of the Tubular Products Div. of The Babcock & Wilcox Co. This is the first plant in the United States, designed specifically to produce stainless steel tubing by the "Ugine-Sejournet" extrusion process, to be placed in actual operation.

The process makes possible extrusion of hollow and solid sections of metals which forge with great difficulty. It also permits finer and more complicated sections than heretofore possible, even with the more readily forgeable steel alloys. The distinguishing feature of this method is the use of glass to act for an extremely short time both as a lubricant for the hot worked metal and as an insulator to protect the die system.

## New Belt System Allows Iron Ore Conveying in Sub-Zero Weather

This is the first winter that a steady stream of vitally needed iron ore is moving out of underground mines to surface stockpiles on rubber conveyer belts during freezing weather. A new conveyer system, which features a turnover arrangement of the belts, overcomes operating hazards found in the sub-zero weather normal to Minnesota and Michigan iron ranges in winter.



Developed jointly by the B. F. Goodrich Company and the Chain Belt Company, the system turns the belt over after the load is delivered. The clean side of the belt therefore always runs on top of the return idlers and cannot clog or cause damaging buildup of tacky materials on idlers or pulleys. Before accepting a new load the belt twists again, so the same carrying surface receives the load.

The turnover action is accomplished by positioning two twist pulleys at each end of the system. It is an easy matter to convert any conventional belt conveyer system into the turnover type. The system is recommended not only for


Nicholson Traps Help

CUT STEAM COST $500,000 A YEAR

At one of the nation's large processing plants a campaign to promote economical steam use by improving heat transfer efficiency has resulted in a yearly saving of $500,000. Credit for a fair portion of this is given to improved steam trapping, which resulted from the installation of Nicholson thermostatic traps. To see why an increasing number of leading plants are standardizing on Nicholsons for positive drainage and faster heat transfer, send for Catalog 751.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 Oregon St., Wilkes-Barre, Pa.

CATALOG 751 or see Sweet's

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

handling of sticky materials, but also for corrosive materials such as salt, fertilizers and sulphur which attack the metallic understructure and return idlers.

## Demonstrator Illustrates Servo Control Systems

Inasmuch as the advantages of servo equipment are becoming increasingly apparent, Servomechanisms, Inc. has constructed a portable demonstration servo control system to show what a typical servo system is and does. The basic method of servo control which it illustrates can be applied to any problem requiring remote control of position or velocity. It is available either to individuals considering the use of such equipment for solving control problems or to larger groups for educational purposes.

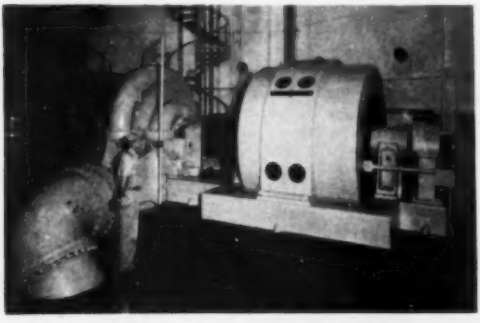
Advanced methods of packaging servo equipment are followed in the design of the demonstrator—that is, all the elements needed for one function are packaged together in one small unit with plug-in connections. The demonstrator consists of only five components attached to a mounting board. These are the station to be controlled, an adapter which contains the controlling station as well as miscellaneous elements of the system such as pilot lights and switches, a servo amplifier, a power supply, and a 1/150 hp motor integral with damping tachometer. With five such basic components it is possible to solve an infinite number of complex electronic and electromechanical problems.

## Radioactive Isotope Reduces Casting Inspection Time

With radium, it used to take 8 to 10 days to complete a non-destructive inspection for soundness of large castings with 1½ to 2 in. wall thickness. Now, according to the research staff of Edward Valves, Inc., radioisotope cobalt 60 cuts down the time to 24 to 36 hrs.

Cobalt 60 has also replaced radium for internal type of examination due to its availability in higher specific activity than natural radium. This makes it possible to use smaller

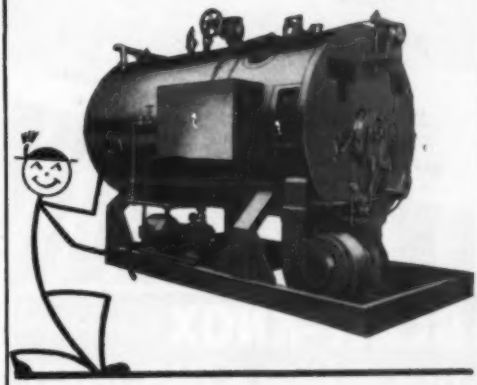
*( Continued on page 146 )*



**MOTOR-PUMP INSTALLATION IMPROVES EFFICIENCY**
***General Electric synchronous motor drives a 60 mgd DeLaval pump at the Louisville Water Company's River Road Pumping Station. The motor is rated at 2500 hp, 13.2 kv, 450 rpm, 1 pf, 3 phase, 60 c. Pumping 1500 gal per kwhr, the new installation is over 8 per cent more efficient than the pump it replaces***


AMESTEAM GENERATOR

JUST SET IT ON YOUR BOILER ROOM FLOOR!



NEEDS NO { FOUNDATIONS / BRICKWORK / LARGE STACK

You Supply Fuel Tank, Gas Vent and Service Connections . . . We Supply the Rest

Nineteen Sizes . . . 10 to 500 h.p.
15# to 200# w.p.
OIL or GAS

*WRITE FOR BULLETIN 1011-C*

AMES IRON WORKS
BOX J-3 OSWEGO, N. Y.
*Builders of Better Boilers Since 1848*

SAFE • STRONG • SECURE
Before specifying or purchasing open steel flooring check these exclusive features of Blaw-Knox Grating...
1. SAFETY underfoot at all times assured by twisted steel cross bars.
2. STRENGTH that only rigid "one-piece" Electroforged construction can provide.
3. SECURITY—no wobble, tilt or rattle caused by loose or lost screws, nuts, bolts.
4. EASY to maintain and paint . . . no sharp corners to clog with dirt.
5. MAXIMUM open area for light and air.
For complete data on Blaw-Knox Electroforged Steel Grating and Stair Treads write for Bulletin 2365.
BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY
2072 Farmers Bank Bldg., Pittsburgh 22, Pa.
BLAW-KNOX Electroforged
STEEL GRATING & STAIR TREADS

MORE POWER TO MATERIALS-HANDLING
WITH QUALITY SILENT HOIST EQUIPMENT
KRANE KAR
KRANE KAR Swing-Boom Mobile Crane speeds and cuts the cost of handling all loads in plant construction, maintenance, repairs; loads and unloads freight cars, trucks, and trailers; stacks loads for storage. 1½, 2½, 5 and 10 ton cap. Ask for Bull. #79.
"SILENT HOIST" CAR PULLERS move and spot freight cars, warp barges, open hopper doors, etc.
Use SH power-driven Capstans, Gypsies, and single and double drum Winches for rigging, skip hoists, cable ways, maintenance, construction, etc. Ask for Illustrated Bulletin #64A.
Thousands of KRANE KARs and SH Car Pullers are serving industries throughout the world.
SILENT HOIST & CRANE CO.
856 63rd STREET, BROOKLYN 20, N. Y.


# Spot news

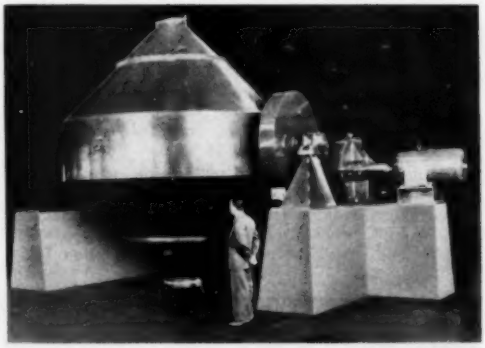
( Continued from page 145 )

source size and increase sensitivity in examination of confined areas in castings. It consists of metallic cobalt pellets normally made from wire cut to lengths approximately equal to the diameter. These cylinders are placed in atomic piles and eradiated for 10 to 12 months. The result, upon removing the metal from the atomic pile, is cobalt 60.

Examination of castings for internal soundness is also possible with X-ray, however equipment necessary for penetration of heavy metal sections is cumbersome in operation.

## Conical Blender Holds Entire Contents of a Railroad Car

Work was recently completed by The Patterson Foundry & Machine Company on a conical dry blender believed to be the largest in the world. The unit is 13 ft in dia, has a total capacity of 1000 cu ft and a working capacity in excess of 700 cu ft. Especially developed for blending a mixture of



technical gelatin and antifoam paste, which has a combined weight of 42 lb per cu ft, the blender holds a batch of approximately 30,000 lb. The entire contents of a railroad car can be intimately and uniformly blended in a single batch operation in this gigantic dry blender.

## Fabrication of Turbojet Compressor Blades Will Aid Mass Production

A new manufacturing process, developed by General Electric's Thomson Laboratory, will crack a bottleneck in the nation's production of aircraft turbojet engines. The process involves fabrication of the stationary, or stator blades of jet compressors in place of the relatively slow and expensive forging technique currently used.

In addition to greatly speeding up blade manufacture, the process promises great savings in critical materials and millions of dollars annually. Furthermore, it is said blade fabrication will relieve pressure on the nation's forging facilities. Considerably less production equipment is needed

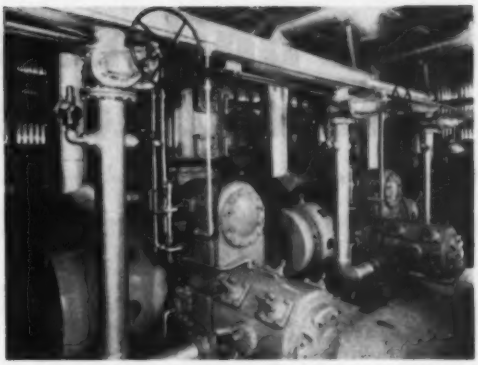
for fabricated blades than for forged blades, and equipment is also less costly.

The compressor, regarded as the heart of a jet engine, consists of a rotor surrounded by a stator. Both have hundreds of precision-made stainless steel blades with air foils similar to that of an airplane wing. As the rotor turns, air is forced through the rotor and stator blades and is compressed as it travels to the rear toward the combustion chambers. Current J-47 production models have approximately 2000 compressor blades, more than half of which are on the stator.

The new fabrication process is based on a principle used for some time in steam turbine manufacture, whereby blades are rolled in long strips, contoured to the proper air foil, and then cut to desired length during assembly. The big problem in development was that of mounting the blades. In the forged blade, a dove-tailed base, which is an integral part of the blade, fits into a blade ring. A new way of mounting solved the problem. A separate base was developed, having an opening in which the blade is inserted and welded. The base is shaped to fill the same area as the present blade ring, thereby eliminating the ring and an expensive manufacturing and assembly process. This base also provides greater resistance against vibration due to occasionally uneven air flow through the compressor.

## Compressed Air Powers Construction Equipment for Broadway Tunnel

Three Ingersoll-Rand air compressors provide power to operate more than 100 air tools, four hoists and four muckers used in the construction of the new Broadway tunnel in



San Francisco. The equipment is operated from air supplied through a 6 in. pipe running from the compressors four blocks away. Each of the three compressor units has a piston displacement of 973 cfm. They operate 24 hr per day, five days a week as the two year project passes the half-way point.

Each unit is driven by a General Electric 150 hp close-coupled synchronous motor, mounted on the compressor frame. This arrangement not only reduces cost of foundations, but also simplifies wiring and pipe-fitting.

The 3400 ft tunnel is a twin-bore vehicular tube with two lanes and two sidewalks in each direction. Although the tunnel will be 3400 ft from portal to portal, the enclosed bore will be only 1660 ft.

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QUICKLY
ACCURATELY
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RESEATING A VALVE
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Illustrated, at top: Model G Indicating Thermometer, flush mounting type with capillary tubing for remote reading. Priced from $18. At bottom: Model V Thermometer (vapor pressure type). Rigid stem for direct mounting. Priced from $10.25.
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# New bulletins and catalogs

**Literature on engineering products and developments**

***Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 131***

**Starting with this issue, the "New Bulletins and Catalogs" department will appear in its entirety in the back section of the magazine. The "New Equipment and Developments" department will appear in its entirety in the front section. This change is being made to allow the reader to follow through each section without interruption, and is in keeping with our policy of making INDUSTRY AND POWER increasingly useful for our readers.**

## AIR & DUST FILTERS & COLLECTORS

***Wet Collectors*** **200**

Multi-wash wet method dust collectors are described and illustrated in 20-page bulletin 510. Design features and typical installations are included. Settling and dewatering equipment, and sludge pumps are also featured. List of available bulletins covering specific applications and equipment is included. Claude B. Schneible Co.

## BOILERS & BOILER ACCESSORIES

***Weighing Systems*** **201**

If your problem is to control the weights or rates of flow of materials in your plant, you should find 56-page brochure 841 a valuable source of information. Diversified line of weighing, batching and proportioning systems are discussed and illustrated. Features, applications and specifications are given. Includes useful information on how to determine the valley angle of a hopper and a table of densities of typical solids as they occur in material handling. Jeffrey Mfg. Co.

## BUILDING MATERIALS & MAINTENANCE

***Vacuum Cleaning Systems*** **203**

Stationary vacuum cleaning systems and heavy-duty portable vacuum cleaners are presented in illustrated 8-page bulletin 125 D. Explains how to clean large areas at less cost and lists many other benefits. Special applications are included. Attachments are listed and illustrated. The Spencer Turbine Co.

***Industrial Vacuum Cleaners*** **204**

Two models of heavy-duty portable vacuum cleaners for wet or dry pick-up are described and illustrated in data sheets 22-50 and 22-60. Includes descriptions of attachments. General Electric Co., Appliance and Merchandise Dept.

## BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

***Unit Heaters*** **205**

Selection and application of blower type unit heaters from 100,000 to 1,500,000 Btu are explained in 56-page catalog DS-327-A. Includes capacity information and performance data for floor, wall and ceiling units to deliver heat directly or through ducts. Outlet arrangements, optional dampers, mixing boxes and intake boxes and filters are described. The Trane Co.

***Heating Coils*** **206**

Steam and hot water coils in both standard and non-freeze types for a wide range of applications are described in 66-page booklet DS-385. Topics covered include advantages, construction features, applications, capacities, dimensions, performance and installation. Illustrations include photos, drawings and diagrams. Tables for pipe capacities under varying steam conditions are included for your personal files. Numerous other products are listed and illustrated. The Trane Co.

## COAL, ASH & BULK HANDLING

***Oscillating Conveyers*** **207**

Positive action oscillating conveyers for conveying, feeding, cooling and screening loose bulk materials are the subject of illustrated 24-page booklet 2444. Dimensions, weights, capacity and horsepower charts are given for units from 8 to 48 in. wide with handling capacities from a few pounds to several hundred tons per hour. Actual installations are used to illustrate various applications. Handling of such bulk materials as coal, ores, chemicals and woodchips are listed. Link-Belt Co.

## COMPRESSORS

***Air Compressors*** **208**

Illustrations and descriptions of belt drive and direct motor drive stationary air compressors from ⅛ to 100 hp are presented in 12-page catalog 5110. Features are listed, and engineering specifications and dimensions are included. Schramm, Inc.

***Compressor Accessories*** **209**

"Is Your Air Compressor Capacity Effective?" is the title of 8-page technical bulletin 5, intended to aid you in improving the effective capacity and efficiency of your compressor. Booklet contains 6 pages of useful engineering information, including graphs and piping diagrams. Dimensions, descriptions and illustrations of cooling controls, automatic drain traps, safety controls and strainers are briefly presented. Sarco Company, Inc.

## CONTROLS, REGULATORS & INSTRUMENTS

***Feedwater Gas Analyzer*** **210**

Described in 4-page folder 148BP is an analyzer for measuring dissolved oxygen and hydrogen in feedwater. Advantages, ranges, and accuracy are discussed. Cambridge Instrument Co., Inc.

***Combustion Instruments*** **211**

Smoke and combustion instruments and recorders are described and illustrated in 8-page bulletin 501. Installation and advantages are discussed and several case histories are cited. Diagrams are used to explain automatic

***Rust Preventatives*** **202**

Coatings which may be applied over rusted surfaces without removing all the rust are featured in 16-page general catalog 251. A quick reference contents page lists characteristics and recommended uses for long and short oil type coatings, machinery finishes, heat and chemical resistant coatings, sealers, thinners, and floor finishes. Color chips are used to illustrate the exact colors. In addition to detailed information and technical data on each type of coating, instructions for application, resistant qualities, drying times, thinners and special applications are also included. A question and answer section is employed to clarify a few of the most common problems. Rust-Oleum Corp.

combustion control system in which smoke meter is used to control steam jets or overfire air blowers. Ess Instrument Co.

**General Catalog** **212**

Brief descriptions and illustrations of approximately 100 measuring and control instruments and valves are contained in 28-page catalog 5000. Incorporates an index and is arranged in a quick-reference style to be of additional value to your reference file. Minneapolis-Honeywell Regulator Co., Industrial Div.

**Instrumentation** **213**

Illustrated 8-page booklet R-8, entitled "Results", may contain suggestions to aid in operation of your boiler room or power plant. Written in an interesting manner, it presents the case history of a large independent electric power producer. Equipment and operating philosophy which enabled this plant to achieve a high efficiency is covered. In addition to discussions of the use of steam, fuel and ash handling and plant steam demand, the combustion control system is also fully described and illustrated. The Hays Corp.

**Regulating Valve** **214**

Large cutaway illustration of a pilot-operated regulating valve with detailed explanations of design features is presented in 4-page folder 700. Includes discussions on how control function of valve can be changed by using a different sensitive pilot. Spence Engineering Co., Inc.

## ELECTRICAL HEATING UNITS

**Electric Air Heaters** **215**

Portable and built-in electric air heaters are described in illustrated 4-page folder F-1530. Convection, blower, duct and radiant types are shown along with suitable automatic controls. Application photographs illustrate factory and office uses. Edwin L. Wiegand Co.

## FILTERS, STRAINERS & PURIFIERS

**Filters** **216**

Bulletin FK-040, 12 pages, features a filter for removal of such materials as sand, metal chips and abrasives from water, coolants, cutting oils and other light fluids. Working details and construction are described with cutaways, photos and line drawings. Numerous case histories are presented. Engineering information and several design data and flow tables are also included. The Cuno Engineering Corp.

**Filter Presses** **217**

Filter presses for clarification of practically any liquid are the subject of 32-page catalog 52. How they operate, how to select, advantages, design features, materials of construction, filter media, applications and approximate costs are fully discussed and illustrated. Also presents horizontal plate-enclosed tank type pressure filter capable of average flow rates up to 60 gal per sq ft filtering area per hr. T. Shriver & Co., Inc.

*( Continued on page 150 )*

Airetool single expansion tube cleaner for straight tubes. Excellent for removing heavy scale. Other types for curved tubes.
Airetool ball-bearing type tube expander for perfect expansion of tube ends into tube sheets.
They've Got 'Em
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AIRETOOL IS THE FIRST NAME IN TUBE MAINTENANCE EQUIPMENT
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IF IT'S GOOD ENOUGH FOR ULTRA-FINE RADIOACTIVE DUSTS
IT'S IDEAL FOR YOUR MOST HAZARDOUS JOBS

Sectional view of MIKRO-COLLECTOR showing felt filter bags and reverse jet cleaning ring.

The MIKRO-COLLECTOR* has virtually no rival in the collection of radioactive dusts of ultra-fine particle size. Its installations for this purpose alone, during the past year, have a combined capacity of more than 100,000 cfm.

We can show you data which should leave no doubt in your mind that a MIKRO-COLLECTOR can handle your job economically and efficiently, if it falls in either of these classifications:

1—*Elimination of atmospheric pollution, regardless of the dangerous or noxious quality of the dust, or the minute size of the dust particles.*

2—*Full recovery of a valuable product.*

This is made possible by the MIKRO-COLLECTOR's pressed felt filter medium and its Hersey reverse-jet cleaning ring, which assure the very highest possible dust recovery.

**10 Reasons**

why a MIKRO-COLLECTOR will best help you win a war with Dust

1. Phenomenal Filter Rates
2. Highest possible recovery of solids
3. Require less filter surface, floor area
4. Extreme simplicity, low upkeep, minimum attention
5. Selected wool felt filtering medium
6. Reduced number of filter bags; quick changeover
7. Continuous, fully automatic operation
8. Uniform air flow
9. Easy handling of dust loads, damp or dry
10. Thorough survey and diagnosis of dust problem

SEND FOR—actual sample of felt used in MIKRO-COLLECTOR.

*Patents applied for by H. J. Hersey, Jr. and Pulverizing Machinery Company

PULVERIZING MACHINERY COMPANY
44 Chatham Road Summit, New Jersey

MIKRO-COLLECTOR
By the makers of
MIKRO-PULVERIZERS and MIKRO-ATOMIZERS


# New bulletins and catalogs

*( Continued from page 149 )*

***Oil Filters*** **218**

Oil filters for engines of all types, oil burners, and general industrial and machine tool filtration are described in 40-page catalog. In addition to specifications, each type is illustrated by photo or cross section. Useful ASTM viscosity-temperature chart for liquid petroleum products is also included. Purolator Products, Inc.

***Dehydrator*** **219**

Data sheet presents description, dimensions, specifications and illustrations of a dehydrator for diesel fuel, gasoline, kerosene and fuel oils. Capacities are 350 and 600 gpm. Construction and operating elements are also described. Bowser, Inc.

***Pipe Line Strainers*** **220**

Pipe line strainers from ⅛ to 36 in. are described and illustrated in 16-page data manual 951. Includes useful information on factors in selecting types and sizes for specific applications, and the effect of flow rate, screen loading and viscosity of fluid on pressure drop. J. A. Zurn Mfg. Co.

***Purifiers*** **221**

Line type purifier removes almost 100% of entrainment from vapors, according to illustrated data sheet 200. Advantages, operation and dimensions are included. Applications listed include exhaust steam installations, compressed air lines, process gas lines and vapor lines following evaporation. V. D. Anderson Co.

***Filter Gages*** **222**

Engineers concerned with filter plants will find 4-page bulletin 450-H10 of interest. Mechanically operated filter gages are described and illustrated with photos. Principles of operation and special features are discussed. Includes gage specifications and several layout drawings of typical installations. Builders-Providence Inc.

***Diesels*** **223**

One, two and three cylinder, 4-cycle diesel engines, for continuous duty or standby service, are the subject of 12-page bulletin 194. These units, ranging in size from 10 to 45 hp within a speed range of 1200 to 1800 rpm, are offered as self-contained units with generator, pump, or with stubshaft or clutch power take-off for direct connection or belt drive. Design and operation features are described, and complete engine specifications are included. A large cutaway is used to show construction features. In addition, all main engine parts are illustrated and described. Specific applications are listed. Nordberg Mfg. Co.

## FUELS & FIRING EQUIPMENT

***Burners*** **224**

Combined gas and oil burners are described and illustrated in 4-page folder 205A. Advantages and construction features are presented, along with descriptions of important working parts. Peabody Engineering Corp.

***Gas Burner*** **225**

If you are considering the use of gas as a fuel, technical data sheets B 22/1 and B 22/2 may be of interest. Specifications and installation data are presented. Drawings of suggested methods of application are included. The Webster Engineering Co.

***Burner Tips*** **226**

Complete line of burner tips for various gas-fired applications is described and illustrated in 28-page catalog B-11. Includes advantages and engineering data. Also lists such equipment as industrial carburetors, hand torches, fire pots, peep hole covers, fire checks, dynamic dryers and immersion heaters. The C. M. Kemp Manufacturing Co.

**HOW TO REQUEST FREE BULLETINS**

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## MECHANICAL POWER TRANSMISSION

***V-Belts*** **227**

Long life and extra grip are advantages of improved single groove V-belts, according to pocket-size 8-page pamphlet 6830 B. Advantages are discussed and drawing is employed to show fabrication. Lists standard sizes and belt numbers. Raybestos-Manhattan, Inc., Manhattan Rubber Div.

***Flexible Shaft Handbook*** *

"Flexible Shaft Handbook", third edition, is a 256-page cloth-covered, bound reference manual providing a comprehensive and authoritative picture of the range and scope of flexible shafts in transmitting power and remote control. Full details on construc-

tion, selection and application are presented. In addition, flexible casings and various angle adapters and fittings used in conjunction with flexible shaft applications are included. An appendix of engineering tables and data adds to the value of the book. ***Copies of the book may be secured by sending requests on company letterhead directly to The S. S. White Industrial Div., Dept. IP, 10 East 40th Street, New York, N. Y.**

***Canvas Belting*** **228**

Stitched canvas conveyer and elevator beltings are described in 32-page catalog. Complete details for ordering, installing and maintaining various belts are given. Numerous photos depict belts in actual use. Advantages, construction features and recommended applications are also included. Special technical data section presents considerable engineering information and suggestions. C. R. Daniels, Inc.

***Load Computation Manual*** **229**

You will want this valuable 68-page manual of short-cut methods for calculating loads on bearings for your engineering file. Contains many valuable formulas and tables. Manual is step-indexed for quick reference. Marlin-Rockwell Corp.

**MOTORS & GENERATORS**

***Electrical Maintenance*** **230**

"Maintenance of Industrial Electrical Equipment", 6-page folder 21P9, is an informative article discussing advantages of a preventive maintenance program for all electrical equipment. Valuable suggestions and recommendations are included. Several graphs supplement the text. James G. Biddle Co.

***Generators*** **231**

Two articles of interest to electrical engineers are available in reprint form as 2-color illustrated pamphlets 05R-7773 and 05R7776. "Supercharged Cooling of Generators" describes some of the important steps taken in designing the first supercharged hydrogen-cooled generator. "Five Stages to Stability" describes how discrepencies in generator output voltage are corrected by a series of amplifying stages in rotating regulators. Allis-Chalmers Mfg. Co.

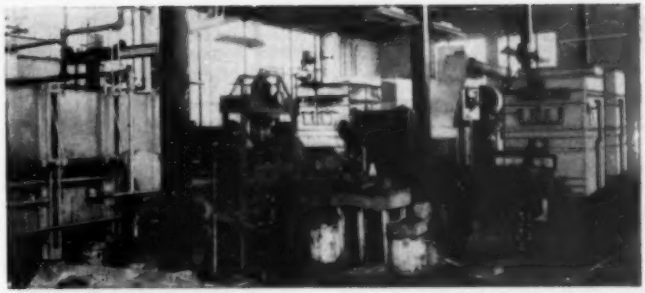
***Enclosed Motors*** **232**

Totally-enclosed, fan-cooled motors with tube-type, air-to-air heat exchangers are presented in 6-page folder 51B7149B. Available in either standard or explosion-proof designs, the motors range from 40 hp at 600 rpm to 800 hp at 3600 rpm. Photos and cross section show details, and large cutaway is employed to point out construction features. Actual installations are also shown. Allis-Chalmers Mfg. Co.

***Voltage Regulators*** **233**

Application, construction, operation and installation of Rocking Contact voltage regulators for small alternating current generators is described in a 4-page folder D-51. Illustrations include photos, diagrams, and dimensional drawings. Allis-Chalmers Mfg. Co.

***( Continued on page 152 )***

# Niagara Aero Heat Exchanger quickly pulls down the initial peak load of heat in quenching . . . and saves cooling water

**Accurate control of quench bath temperatures and quickly effective capacity to handle the initial peak load of heat in quenching prevents production set-backs, increases the output of your heat treating department, prevents oil fires, saves you losses from rejected parts.**

**Niagara Aero Heat Exchangers give you this control in both furnace and induction hardening methods. They prevent both over-heating and over-cooling of the quench bath. Hundreds of heat treaters know they prevent many troubles, constantly improve quality and increase production.**

**They quickly pay for themselves by saving cooling water coils and extend your quench capacity without extra water or cooling tower.**

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***Experienced District Engineers in all Principal Cities of U. S. and Canada***

# New bulletins and catalogs

*( Continued from page 151 )*

***Motor Control Center*** **234**

If you need a motor control center for two or more a-c motors up to 200 hp, 600 v, 24-page brochure GEA-4979A may be of interest. Installation and design features are photographically illustrated. Includes complete specifications and selection charts. General Electric Co.

***Motors*** **235**

Complete data on heavy duty single phase and polyphase motors are presented in 8-page catalog. Motors range in size from 1/20 to 5 hp. Prices are also included. Triad Engineering Corp.

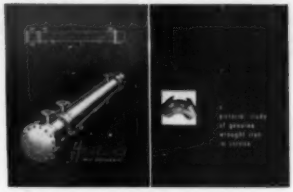
## HEAT EXCHANGER EQUIPMENT

***Heat Exchangers*** **236**

Cascade type heat exchanger utilizing specially constructed Pyrex glass tubes is featured in 12-page bulletin PE-8. States they provide an efficient economical means of cooling corrosive liquids. Drawing and photos aid in presentation of data on construction and installation details. Charts and nomographs are included to aid in the calculation of heat transfer requirements. Corning Glass Works, Technical Products Div.

***Heat Exchangers*** **237**

Heat exchangers in relation to their use for heating and cooling, condensing and for evaporating are presented in 8-page bulletin. Cross-sections of heads, shells and tube bundles together with brief descriptions and recommended applications are given. Tank heaters and fuel oil heaters are also described. Superior Combustion Industries, Inc.



## MATERIALS OF CONSTRUCTION

***Wrought Iron*** **238**

"Proof by Performance", 8-page booklet, describes in a non-technical manner a number of installations in which wrought iron gave outstanding service over long periods of time. Corrosion resistance and durability are stressed. Case histories cited include wrought iron used for pipes, pilings and structural members. Each is well illustrated with photographs. A. M. Byers Co.

***Metal Mesh*** **239**

"How to make a little metal go a long way" is the theme of a 26-page booklet 493 EM. This instructive booklet illustrates many interesting and useful applications using metal mesh, including numerous machinery and belt guards, enclosures and gratings. Included are complete engineering specifications on numerous types of mesh, photos in actual size, and a section on accessories used for fabricating parts. A special section on techniques of fabricating expanded metal, and engineering data on air flow through several types of mesh are featured. Penn Metal Company, Inc.

## PACKINGS & GASKETS

***Packings & Gaskets*** **240**

How to get the best results from packings is outlined in useful 6-page folder PK-61-A entitled, "Packings for the Power Plant". Each of 28 types of packings and gaskets is illustrated, briefly discussed and numbered for quick reference. These numbers are then used on a schematic drawing of a power plant to indicate recommended applications. Johns-Manville.

***Packing Rings*** **241**

Graphitic non-metallic packing rings are featured in 4-page folder R 112. Advantages, applications, and valuable information on how to order are included. Also presents a liquid-end piston for reciprocating pumps which simplifies packing installation. Sims Pump Valve Co., Inc.


NEW THREAD COMPOUND

Licks Stud Freezing Even at 1800° F.!

SAFE for all high temperature applications!

SAFE for Stainless and Alloy Steels, too, will not pit or corrode!

IDEAL as a cutting compound to prevent galling of Stainless Steel!

Make a convincing test of Fel-Pro C-5 "Hi-Temp" Thread Compound at our expense. Then you can be sure that C-5 will do everything we say it will do. See how it cuts heater dismantling time—how it cuts costly stud breakage and eliminates pitting. Then you will standardize on C-5 just as have some of the nation's largest refineries, utilities and process industries. Write for FREE Sample and data sheet TODAY!

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**Felt Gasketing** 242

Corrosion resistant impregnated felt gasketing is the subject of 6-page folder SP-1050-5M. Material is stated to be extremely versatile and many diversified applications are discussed and illustrated. Advantages and available size are included. Products Research Co.

**Rubber Sheet Packings** 243

Engineering specifications, descriptions and recommendations for a complete line of rubber sheet packings are presented in a brief, easy-to-read 8-page bulletin. Standard packages and weights are also included. Raybestos-Manhattan, Inc., Packing Div.

**Oil & Grease Seals** 244

Catalog 10, 100 pages, will make a valuable addition to your ready reference files. Seals for bearings and mechanical seals for rotary shafts are described and illustrated. Drawings and cutaways depict typical applications. Visual index is used to show correct applications at a glance. Engineering data, installation instructions, trouble tips, and information on how to order are included. Three pages of engineering reference tables add to the booklet's usefulness. Garlock Packing Co.

**HOW TO REQUEST FREE BULLETINS**

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**Metallic Packings** 245

Illustrations and descriptions of flexible metallic packings are presented in 8-page bulletin. Included are service recommendations and illustrations of "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Standard sizes, packages and approximate weights for each type are also listed. Raybestos-Manhattan, Inc. Packing Div.

**LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS**

**Separators** 246

Informative 44-page booklet S. A742 may solve your problems of separation and clarification. Variety of industrial centrifugals of continuous separator type are featured. Comprehensive explanations of how they operate, construction and special features are included. Booklet is well illustrated with photos and cutaways. List of applications includes clarification and reclamation of oils in power plants and engine rooms. De Laval Separator Co.

**PACKAGED STEAM GENERATORS**

**Packaged Steam Generators** 247

"Steam in a package", 14-page booklet ID-51-115, presents 3-pass packaged steam generators from 525 to 8625 lb steam per hr. Booklet is well illus-

*( Continued on page 154 )*

HEWITT-ROBINS

# Unloads HOPPER CARS Faster . . . Cleaner

*Hewitt-Robins Car Shakeout*
*Really Shakes OUT The Car*

**Saves Time:** Unloads 70-ton hopper cars "*broom clean*" in as little as 90 seconds . . . even when loaded with hard-packed material.

**Saves Manpower:** Everything under "finger-tip" control except opening the hopper doors. Two men —or even one—can handle entire operation.

**Saves Money:** Less car damage—no need for demurrage.

**Here's Proof:** Operators say . . . "It is in operation 24 hours a day unloading ⅜" x 0" coal and *saving us $70.00 a day* since first put into operation in 1946" . . . "It has *reduced our unloading time* from 100 man-hours to 18 man-hours per day" . . . "*Pays for itself* every 105 days by merely eliminating damage to railroad cars."

*Get The Facts. Write for Bulletin No. 128-A*

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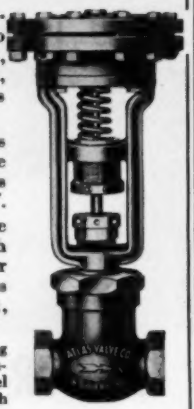
**ROBINS CONVEYORS DIVISION**
270 Passaic Avenue, Passaic, N. J.

# ATLAS
## Type "D" Reducing Valve



**For pressures up to 250 pounds, Steam, Air, Oil, or Gas Service.**

**Stainless Steel Needle Seats, Sizes ½" and ¾".**

**Renewable Disc with Bronze or Stainless Steel Seat, ½" to 2".**

**Regrinding Bronze or Stainless Steel Bevel Disc with Bronze or Stainless Steel Seat, ½" to 2".**

**Screwed Ends. Flanged Ends if desired. Diaphragm Operated. Bronze Bodies.**

**For complete information concerning ATLAS Type "D" as well as other Pressure Reducing Valves for steam, water, air, gas, or oil, ask for our 52-page Bulletin 1-A. The coupon below makes it easy to ask for 1-A or data on other ATLAS products as listed.**

**Type "D" is well liked by engineers for reduced working pressures from one pound to 150 pounds. Unexcelled for controlling the flow or pressure of steam, gas, hot oil or hot water where a simple tight seating valve is required.**

In addition to the above, Bulletin 1-A shows a Type "D" for pressures up to 600 lb. and for reduced working pressures from 1 to 250 lbs.

Type "D" valves are unusually simple as will be discovered when you study Bulletin 1-A. They give accurate and close regulation. Easy to inspect. Durable. Efficient. Made by a concern that has specialized in regulating valves exclusively for over half a century.

**ATLAS VALVE COMPANY**
REGULATING VALVES FOR EVERY SERVICE

**287 SOUTH ST., NEWARK 5, N. J.**
**Represented in Principal Cities**

☐ Without obligation, please send me the ATLAS Regulating Valve Bulletin No. 1-A. Also, please send complete data on the following products:

| | |
|---|---|
| ☐ Damper Regulators | ☐ Pump Governors |
| ☐ Temperature Regulators | ☐ Oil Control Cocks |
| ☐ Exhaust Control Systems | ☐ Humidity Controllers |
| ☐ Pressure Regulators | ☐ Thermostats |
| ☐ Campbell Boiler Feed Water Regulators | ☐ Balanced Valves |
| | ☐ Control Valves |

Name .....

Firm .....

Address .....


# New bulletins and catalogs

*( Continued from page 153 )*

trated with photos and drawings, and features 2-page, 3-color cutaway of the unit. Advantages, construction, and how it operates are presented in a quick reference style. York-Shipley, Inc.

***Packaged Steam Generators*** **248**

Basic construction and design features of plant assembled steam generators, with or without superheat, are presented in illustrated 20-page booklet P6-51-2. Includes tables of engineering specifications for units from 10,000 to 30,000 lb steam per hr and design pressures from 250 to 825 psi. Also includes section on control and instrumentation. Foster Wheeler Corp.

***Packaged Steam Generators*** *

Manual on packaged steam generators, 208 pages enclosed in leatherette binder, contains data required by architects and engineers for writing specifications for boiler installations. Drawings show application of packaged units for various steam requirements, and complete specifications required for each are included. Data for line of packaged steam generators and various types of burners are also given. Diagrams give piping requirements and connection sizes for each unit. Electrical wiring diagrams and output charts are also presented. ***A limited number of manuals are available. Please write on company letterhead direct to York-Shipley, Inc., Dept. IP, York 4, Pa.**

### PIPE & FITTINGS

***Expansion Joints*** **249**

Corrugated expansion joints solve vibration, misalignment and expansion problems in scores of industrial applications, according to 16-page booklet CMH-127. Designs, applications and data for several types suitable for use from vacuum to 5500 psi and -400 to 1600 F are discussed and illustrated in quick reference style. A section intended to act as a guide for proper selection and application includes numerous tables, data and formulas which you may want in your files. Flexonics Corp., (formerly Chicago Metal Hose Corp.)

***ERW Tubing*** **251**

If you are concerned with ERW tubing for mechanical and pressure purposes, a chart now being offered should be a useful addition to your engineering data files. Chart covers tubes from ½ to 4 in. OD, in various carbon steel grades and produced to meet numerous standard specifications. Both average and minimum wall requirements are covered. Babcock & Wilcox Tube Co., Welded Tube Div.

***Tubing Maintenance*** **252**

"Some Experiences in Service", 40-page booklet TR-516, should be of assistance to engineers concerned with obtaining failure-free service from high-pressure, high-temperature tubing installations. Results of many investigations of failures in tubing used in such equipment as boilers, cracking stills, heaters and heat exchangers are presented and illustrated. The Babcock & Wilcox Tube Co.

***Welding Fittings*** **253**

Welding fittings for use with stainless steel light gage O. D. tubing are described and illustrated in 16-page catalog 748. Fabrication, advantages, analysis, theoretical bursting pressures, complete list of dimensions and how to order are discussed. Also gives useful table on friction of water in pipes. Price lists are included. Tri-Clover Machine Co.

### PUMPS

***Centrifugal Pumps*** **254**

Construction features and specifications for several types of centrifugal pumps are presented in illustrated 12-page bulletin W-350-B11A. In addition to general duty pumps, several types are for corrosive liquids. Mechanical seals are also presented. Worthington Pump and Machinery Corp.

***Centrifugal Pumps*** **255**

Illustrated 40-page instruction booklet 08X7613, containing complete information on installation, operation and

***Technical Paper*** **250**

"Application of Direct-Connected Synchronous Motors to Reciprocating Compressors" is a reprint of a technical paper. This discussion deals largely with consideration of proper rotor flywheel effect as a preventative measure for voltage fluctuations when driving reciprocating compressors with direct-connected synchronous motors. Examples, complete with formulas, sample calculations, and reference curves are included. Photos and drawings are used to illustrate. This 12-page publication 1200-TEC-1111 was published to serve as a valuable addition for your engineering file. Electric Machinery Mfg. Co.

repair of single-stage, double-suction centrifugal pumps, will be of interest to you. Includes a quick reference guide listing 40 possible causes of trouble in pump operation and their cures. Also contains a page to be used as a permanent record, which is arranged to enable the pump operator to see at a glance the life of any parts replaced or improvements due to substitute materials. Allis-Chalmers Manufacturing Co.

***Rotary Pumps*** **256**

Heavy duty, vane type rotary pumps are the subject of illustrated 4-page bulletin W-485-B1. All models are positive displacement, sliding vane type, and are manufactured with both external and internal bearing design. Worthington Pump & Machinery Corp.

***Centrifugal Pumps*** **257**

Advantages, efficiency construction features and dimensions of single stage, double suction centrifugal pumps are discussed in 6-page folder 240. Capacities are from 50 to 600 gpm. Large cutaway is employed to show component parts. Table shows proper sized pump and required horsepower for varying heads and capacities. Warren Steam Pump Co., Inc.

**HOW TO REQUEST FREE BULLETINS**

**Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly.**

***Centrifugal Pumps*** **258**

Non-clogging centrifugal pumps for general industrial and specialized uses are featured in 18-page catalog 250. Design features, principles of operation, applications and engineering data are discussed and illustrated. Useful information on loss of head due to friction, viscosity of liquids, how to figure head on a pump, suction and discharge piping, effects due to change of speed, and maintenance suggestions are included. Tri-Clover Machine Co.

***Ejectors*** **259**

Informative 20-page bulletin 512 presents complete line of jet pumps, ejectors, eductors, exhausters, and syphons. In addition to standard models, numerous special purpose models are described, and pumps of special materials can be supplied in some types. Illustrated sections on jet pump principle and typical application arrangements are featured. Booklet contains complete engineering information. Penberthy Injector Co.

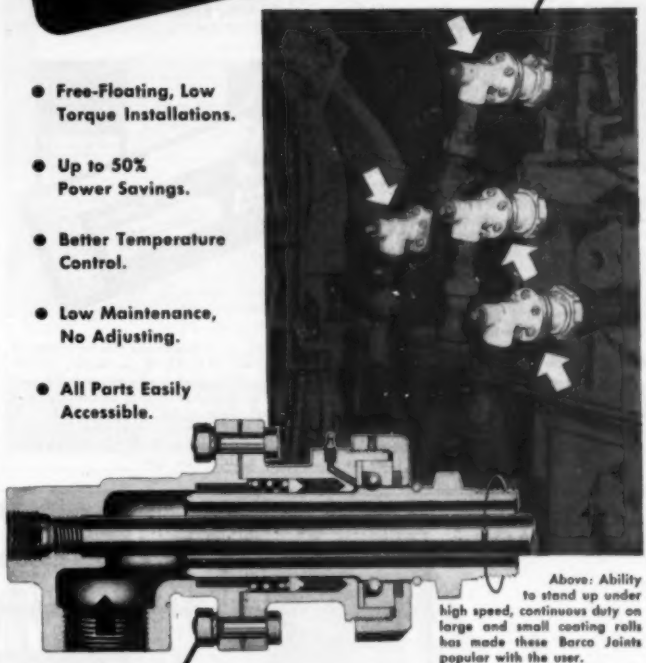
***Pump Valves*** **260**

Pump valves and graphitic packings are discussed and illustrated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order and dimensions are included. Heaters for heating water by blending with steam are also presented. A quick reference index adds to the booklet's usefulness. Sims Pump Valve Co., Inc.

***( Continued on page 156 )***


"Your JOINTS really solved a Problem for us!" Says MAINTENANCE ENGINEER in this Paper Converting Plant

- **Free-Floating, Low Torque Installations.**
- **Up to 50% Power Savings.**
- **Better Temperature Control.**
- **Low Maintenance, No Adjusting.**
- **All Parts Easily Accessible.**



**Above: Ability to stand up under high speed, continuous duty on large and small coating rolls has made these Barco Joints popular with the user.**

**● For complete information on this new Type IBR Revolving Joint, send for Bulletin 300.**

LOW TORQUE (freedom from friction drag) is the key to Barco's *"free floating"* revolving joint installations. With this type of installation, Barco offers numerous advantages: power savings as high as 50% . . . very low maintenance requirements . . . quick, easy accessibility of parts . . . better temperature control . . . ability to withstand vibration and hard usage.

Take a look at Barco's new Type IBR Revolving Joint. Note the wide spacing between bearings which holds bearing loads and wear to a minimum. *Let us give you the complete story; ask for recommendations.* BARCO MANUFACTURING COMPANY, 1831D Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Company, Limited.

**BARCO REVOLVING JOINTS**

*The Only Truly Complete Line of Flexible, Swivel, Swing, and Revolving Joints*

FREE ENTERPRISE — THE CORNERSTONE OF AMERICAN PROSPERITY

# New bulletins and catalogs

*( Continued from page 155 )*

***Pressure Generator*** **261**

Automatic pressure generator for hydrostatic testing or as a booster in hydraulic systems is discussed and illustrated in 4-page bulletin AO-51. Pump, which uses ordinary plant air supply, is available in various models ranging from 25 to 25,000 psi with capacities from 4.1 to 405 gph. Typical pressure system and design features are presented. Milton Roy Co.

***Centrifugal Pump*** **262**

Grease-lubricated, pedestal-mounted centrifugal pump is illustrated and discussed in 6-page bulletin 52B6351B. Available in capacities to 2500 gpm at heads to 550 ft, with stuffing box or mechanical seal, direct or V-belt drive, and in a choice of materials to handle almost any liquid at temperatures to 250 F. Large cutaway shows all working parts and design features. Pedestal arrangements and table of dimensions are included. Allis-Chalmers Mfg. Co.

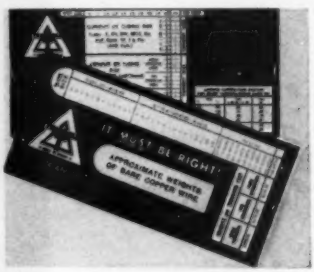
***High-Pressure Pump*** **263**

If you need a source of high pressure fluid power, this 6-page folder presenting an integral electric drive plunger type pump should be of interest. Pump is available in capacities from 1.03 to 62.58 gpm and 1200 to 20,000 psi. Folder incorporates large cutaway to illustrate design features, and several case histories are presented to demonstrate applications. Specifications are also included. Kobe Inc.

## ELECTRICAL DISTRIBUTION

***Wire Calculator*** **264**

Calculator, made of plastic, shows at a glance the approximate weight per thousand feet of solid and stranded wire and cable with one, two or three conductors. Reverse side shows size of conduit or tubing needed for various




numbers of conductors when using R, RH, RW, RF 32, RU, RUF, RUW, TF, T, TW, and lead-covered RL and RHL cables. Also gives allowable current carrying capacities of conductors and ampere correction factor for room temperatures over 30 F. Triangle Conduit & Cable Co., Inc.

***Dry-Type Transformers*** **265**

Bring your reference file up to date with illustrated 8-page bulletin 61X-7088B containing the proposed AIEE guide for the use of openly ventilated dry-type transformers with Class B insulation. Includes general recommendations on installation, inspection, storage, maintenance, and operation for distribution and power dry-type transformers in ratings above 50 kva 600 v, cooled by natural draft or forced draft. Allis-Chalmers Mfg. Co.

***Safety Switches*** **266**

Descriptions and illustrations of safety switches and component parts are featured in 4-page folder 514. Advantages, principle of operation and how it works are presented. Catalog numbers, recently revised, are listed and the older now obsolete numbers are also included for reference. BullDog Electric Products Co.

***A-C & D-C Relays*** **267**

Useful information to relay users, including how to order, is presented in 12-page catalog R-10. Includes detailed discussions and engineering data for many models and specialized types, and illustrations of each. American Relays & Controls, Inc.

***Capacitors*** **268**

Industrial capacitors in many sizes and types are presented in 28-page catalog 200C. Each type is illustrated and briefly described. Lists range of sizes together with pertinent data and prices. Cornell-Dubilier Electric Corp.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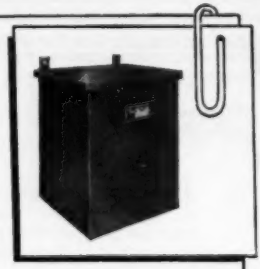

BILL:—

ACME ELECTRIC HAVE A NEW CATALOG GIVING A LOT OF USEFUL IDEAS ON THE APPLICATION OF DRY TYPE TRANSFORMERS "HOW TO ELIMINATE DOUBLE-WIRING SYSTEMS; DISTRIBUTE POWER AT HIGH VOLTAGE; PROVIDE 3-WIRE CIRCUITS; BOOST AND BALANCE VOLTAGE." WRITE FOR BULLETIN AC185. TO ACME ELECTRIC CORP. 523 WATER ST; CUBA, N.Y.

STOP BASEMENT WALL LEAKS

Smooth-On No. 7 Iron Cement stops your basement wall and floor leaks. You can apply Smooth-On No. 7 with a trowel or stiff brush, to cracks, holes, porous spots or seams in concrete, brick, stone walls or floors. This effective Smooth-On Cement will stay in place, because it expands slightly as it sets. You can also use Smooth-On No. 7 to stop leaks in tanks, cisterns, pools, troughs, fountains, etc. Use it too, to seal openings where piping passes through walls. Sold in 1, 5, 20, and 100 lb sizes.

FREE Repair Handbook 40 pages packed with helpful suggestions for repairs to equipment and piping, in the shop, around the home and car. Also ask for leaflet describing the uses of Smooth-On No. 7. Write today.

SMOOTH-ON MANUFACTURING COMPANY, Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

Do it with SMOOTH-ON NO. 7 IRON CEMENT

**Voltage Regulators** 269

Details, performance characteristics, applications, and principles of operation for automatic electronic or electro mechanical voltage regulators are presented in 12-page bulletin S-351. Illustrated with photos, dimensional drawings and electrical diagrams. The Superior Electric Co.

**Tap Changing Equipment** 270

Underload tap changing equipment for single-circuit unit substations, three-phase step voltage regulators up to 750 kva and L.R.C. transformers up to 7500 kva are featured in 16-page bulletin 5112. Descriptions, design features, how it operates and accessories are fully discussed and illustrated with photos, cutaways, drawings and diagrams. Pennsylvania Transformer Co.

**General Catalog** 271

Renewable, one-time and plug fuses, fuse pullers, clamps for fuse clips and test clamps are illustrated and described in 8-page folder F.L.B. 300-C. Many types of automatic oilers are also presented. Lists bulletins available for specific products. Trico Fuse Mfg. Co.

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**Wires & Cables** 272

Electrical wires and cables for mining are described in 52-page engineering catalog. Performance and specification data on insulation and jacket compounds, portable cords and cables up to 5000 v, cables for all purposes, and miscellaneous mine equipment are included. Engineering data on splicing and patching, current carrying capacities, conductor resistance temperature correction factors and formulas for determining amperes are also incorporated. United States Rubber Co.

**Panelboards** 273

Lighting panelboards using thermal magnetic circuit breakers are the subject of 8-page pamphlet 513. Detailed descriptions and specifications are included. Illustrations supplement the text. Unusual feature is the method of distribution which allows units to be assembled to customers' specifications by the distributor. BullDog Electric Products Co.

**Switchgear** 274

Air blast breaker cubicle switchgears in both industrial and station type designs are the subject of illustrated 16-page brochure P.012-3058. Sections covering general descriptions, safety features, types of cubicles, standard ratings and dimensions, specifications, design and operation of breaker, and how to order are arranged for quick reference. Brown Boveri Corp.

**Transformers** 275

"Instrument Transformer Buyer's Guide", 102-page leatherette bound catalog GEA-4626E, is designed to save

*( Continued on page 158 )*


*Another* PALMETTO PALCO *Success Story*

GAEDE DYEING CO.
Paterson, N. J.

CHIEF ENGINEER: Ralph Allan

DATA: DeLaval Centrifugals. Operating conditions — 3600 RPM, 90 ft head pumping through filter, cold spring water 1200 gpm, 40 hp motor, shaft 1-1/2", 3/8" PALMETTO Palco packing. Repacking every 2-3 yrs during routine inspection.

REMARKS: *never had to repair or replace a shaft sleeve in 20 years!*

PALMETTO *Packings*

This outstanding packing is made from soft, long-line, high-tensile cotton roving individually impregnated by the exclusive Palmetto process. *Palmetto Palco cannot score . . .* Cotton fibres burn out if the gland is inadvertently drawn too tight. For centrifugals pumping water or any neutral fluid where temperatures are not in excess of 275 F specify Palco—the packing designed for the assignment. Write for Catalog PC-101—the Palmetto answers to packing problems.

*packing more performance into every application*

**GREENE, TWEED & COMPANY**
NORTH WALES, PENNSYLVANIA

**HENSZEY**
PACKET-TYPE *Automatic*
**CONTINUOUS BLOWDOWN**

- Prevents PRIMING
- Prevents FOAMING
- Prevents SLUDGE
- Prevents SCALE

*(with simple chemical treatment)*

This compact self-contained unit is completely assembled. Can be installed by your own men in hours. It provides completely automatic control of boiler water concentration regardless of variations in boiler load. This is accomplished WITHOUT HEAT LOSS. Maintain clean efficient boilers for substantial savings in fuel, equipment and manpower.

*Also...*
Standardized or special units for ALL CAPACITIES.

**HENSZEY**

*Consult your nearest HENSZEY Representative for FREE Blowdown Chart or write to*

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CONTINUOUS BLOWDOWN and BOILER PLANT SPECIALTIES
Boiler Feed Regulators • Distillation Systems • Heat Exchangers • Feed Water Meters
Flow Indicators • Proportioning Valves
Also MILK EVAPORATORS and PREHEATERS

# New bulletins and catalogs

*( Continued from page 157 )*

time in selecting and ordering current and potential transformers, metering outfits and portable transformers. Ratings, ASA accuracy classifications and prices are listed. Each unit is illustrated. Listings of ratio and phase-angle tests, together with tables covering mechanical and thermal limits of current transformers, are also included. General Electric Co.

***Power Cables*** **276**

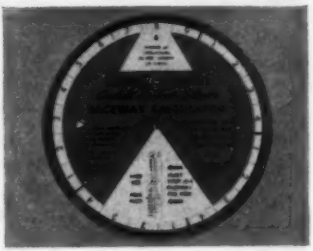
"Selection of Proper Cable Sizes" 12-page bulletin 19-269, is presented as a simple method of selecting proper conductor size for heat-resistant wire and cable in installations typical of those coming under the cognizance of the National Electrical Code. Many useful formulas and tables are included. General Electric Co., Construction Materials Dept.

***Hook Operated Switches*** **277**

Outdoor hook operated disconnecting switches are described in 6-page folder 5104. Switches feature an improved arrangement of high pressure silver to copper contacts. Photos and line drawings are used to illustrate construction features. Engineering data, catalog numbers and dimensions are listed. Delta-Star Electric Co.

***Conduit Product Selector*** **278**

Conduit products selector, 18-111, computes the allowable conduit fill for various sized rubber, thermoplastic, or



lead-covered conductors by a simple dialing operation. The reverse side figures number of conductors allowed in the most commonly used outlet, switch, and utility boxes. General Electric Co., Construction Materials Div.

## REFRACTORIES

***Refractories*** **279**

Hydraulic setting refractories for casting special refractory shapes and for gunning and slap troweling applications are the subject of 12-page brochure RC-28A. In addition to discussion of advantages, applications and specifications, the booklet also contains suggestions for solving maintenance problems and recommendations for casting shapes and linings. Photos show typical uses and illustrate handling methods. Johns-Manville.

## STEAM SPECIALTIES

***Steam Traps*** **280**

Balanced pressure thermostatic steam traps for pressures to 300 psi and capacities to 36,500 lb condensate per hr are discussed in 4-page folder 250-A. Construction details, operating principle, advantages and maintenance are discussed and illustrated with photos and cutaways. Screwed strainers are also briefly presented. Sarco Co., Inc.

***Steam Traps*** **281**

Float-thermostatic steam traps—how they operate and advantages—are illustrated and discussed in 4-page folder 450-A. Capacities range from 70 to 110,400 lb condensate per hr. List of prices and capacities is included. Sarco Co., Inc.

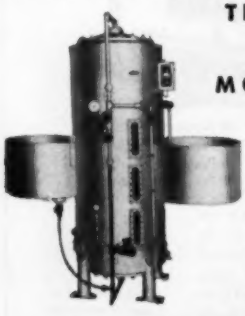
## TANKS

***Expansion Roof Tanks*** **282**

Construction, types, features, and standard and special fittings for double deck floating roof storage tanks are described and illustrated in 20-page bulletin. Includes report by Underwriters Laboratories, Inc. to determine fire retardant values of these tanks. Also includes useful charts of storage data obtained by studies in the petroleum field. Operating and cost comparisons are also presented. Graver Tank & Mfg. Co., Inc.


HIGH PURITY
WATER
*For Boiler Feed, Process & Other Needs*

THE LOW COST*
Penfield
MONO-BED WAY



Operating on the most efficient deionizing technique known (intimately mixed cation and anion resins in a single unit tank), the raw water passes through a Penfield Mono-Bed Demineralizer only once — *yet comes out with a mineral content of virtually zero.* No heat or steam power is ever required, and regeneration of the resins is accomplished by simple gravity and displacement methods.

***COSTS LESS TO PURCHASE, OPERATES FOR LESS THAN 15¢ PER 1000 GALS.**

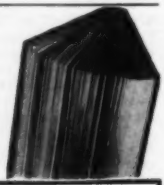
Whether your requirements for dependable, high-purity water are 10 g. p. h. or 10,000 g. p. h., there is a Penfield "Planned Purity" System waiting to make important savings for you in both original equipment and operating costs. Write today for new catalog showing all Penfield water-treating equipment.

**PENFIELD MANUFACTURING CO., INC.**
19 High School Ave., Meriden, Conn.
FILTERS · SOFTENERS · DEGASIFIERS · DEMINERALIZERS

Penfield "Planned Purity" PAYS!



**How long will existing fuel supplies last?**



**— and what can we do against the day they are exhausted?**

HERE is a key to some of the answers in this thorough census of our energy sources—past, present, and future. The book presents a detailed review of the size of fuel supplies, the factors that affect their rate of depletion, what sources may supplement them, and what may eventually succeed them. Everything from fossil fuels and hydroelectric power generation—to nuclear and solar energy is discussed in a highly-readable manner. Comparisons are set up among all the important sources of energy, and definite programs are proposed for future developments.

*Just Published!*
**ENERGY SOURCES**
**—THE WEALTH OF THE WORLD**
By Eugene Ayres
Gulf Research & Development Co.
and Charles A. Scarlott
Editor, Westinghouse Engineer
344 pages. 114 illustrations. over 60 tables. $8.00

*A sound and interesting treatment*

- evaluates oil, coal, oil-shale, peat, and tar-sand reserve figures
- analyzes efficiencies of energy consuming devices and conversion processes
- weighs energy losses in production, mining, transportation, etc.
- clarifies the meaning of "proved oil reserves"
- explains energy values of land and marine vegetation, wind and tide, earth heat, atmospheric electricity, the Claude process, etc.
- rationally examines nuclear energy and the utilization of solar power
- presents a thought-provoking Energy Balance Sheet

ORDER FROM
**INDUSTRY AND POWER**
Readers Service Dept. St. Joseph, Michigan

**Vent Valves** **283**

Features, advantages, specifications, prices and operating data for pressure-vacuum vent valves, with or without flame arrestor element, are presented in 24-page illustrated bulletin E-601. Includes 14 relieving capacity charts, one for each valve size. Black, Sivalls & Bryson, Inc.

**Fuel Oil Heaters** **284**

Oil tank suction heaters and oil preheaters are described and illustrated in 6-page catalog 714. Advantages are explained and capacities and dimensions are listed. Hauck Manufacturing Co.

## TOOLS

**Keyway Broaches** **285**

Would you like to cut your own keyways by hand quickly, and at low cost? Keyway broaches and sets are described and illustrated in 8-page catalog I. Also includes reference information for your files on keys and keyways. Arbor presses and magnetic base for quick, convenient positioning of dial indicator gages are also described. The du Mont Corp.

**Electronic Stethoscope** **286**

"How to Cut Costs on Equipment Maintenance", 4-page folder, describes and illustrates electronic stethoscope for use by maintenance men to locate and diagnose trouble in mechanical equipment. Specifications and applications are listed. American Name Plate & Mfg. Co., Anco Instrument Div.

**Pipe Tools** **287**

Information on pipe tools including pipe and bolt machines, ratchet threaders, reamers and cutters is contained in catalog and data book. Four pages are devoted to an instructive operating guide, which discusses and illustrates how to locate and correct pipe tool difficulties. Beaver Pipe Tools, Inc.

**HOW TO REQUEST FREE BULLETINS**

**Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly.**

**Tube Expanders** **288**

Tube expanders for all types of steam boilers and heat transfer equipment are listed in 4-page illustrated catalog 204-C. Descriptions, illustrations and size and price lists of each type of expander are included. The Gustav Wiedeke Co.

## TURBINES

**Steam Turbine Generators** **289**

Design and construction features of steam turbine generator units manufactured in NEMA ratings of 2000 to 7500 kw are described in 8-page bulletin 03B7654. Turbines are built in condensing, non-condensing and automatic extraction types. Cross sections and cutaways are employed to illustrate construction features. Bulletin points out how a wide range of applications can be met with a custom-built combination of standard components, due to flexibility and simplicity of design. Allis-Chalmers Mfg. Co.

## THERMAL INSULATION

**Heat Insulation** **290**

Hydrous calcium silicate insulation is the subject of 8-page bulletin KH3-517. Graphs, tables, drawings, and photos depict uses up to 1200 F. Forms from 1/4 to 72 in. dia and vessels from 6 to 60 ft are listed. Data on physical characteristics, recommended thicknesses, efficiences and other application facts are also included. Owens-Illinois Glass Co., Kaylo Div.

## VALVES

**Port Valves** **291**

"How to select an air operated adjustable port valve" is outlined in a section of 12-page brochure 1800. Use of diaphragm actuators with adjustable port valves is discussed, and applications, principles of operation and engineering specifications are included. Minneapolis-Honeywell Regulator Co., Industrial Div.

**Relief Valves** **292**

Four page folder describes, illustrates, and lists specifications for pop-safety valves for steam, pressure-relief

*( Continued on page 160 )*

FOR THE DEFENSE
. . . of your machinery and equipment, use a CLEMENTS-CADILLAC blower-suction cleaner to fight Dirt, Dust, and Grit. It routs these enemies effectively, quickly, economically.
Eligible under C.M.P. regulations
MACHINERY
MOTORS
STOCK BINS
REFUSE
SAVE
TIME • MONEY
PREVENT DAMAGE TO MACHINERY WITH THE
CLEMENTS CADILLAC
Made in 5 models with attachments for every cleaning job.
PORTABLE COMBINATION BLOWER-SUCTION CLEANER
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ASK YOUR MILL SUPPLY DEALER OR WRITE US FOR DATA

REVOLUTIONARY
ADJUST-ANGLE THERMOMETER
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For Dial Indicating and Recording Thermometers, Send for Catalog 325.
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# New bulletins and catalogs

*( Continued from page 159 )*

valves for such liquids as water and oil, and safety-relief valves for air, gas and vapor. Kunkle Valve Co.

### WATER TREATMENT

***Demineralizers*** **293**

Demineralizers of various types are presented in a series of data sheets. Included in a folio, the data sheets feature a large photo of each unit and a line drawing. In addition to a full description of the parts, specifications and performances are also listed. Penfield Mfg. Co., Inc.

***Stream Pollution*** **294**

"Lime . . . The Low Cost Way to Prevent Stream Pollution" is a 12-page illustrated booklet describing the use of dolomitic lime for efficient treatment of industrial wastes. Its use for treatment of pickling liquors, plating wastes and oil in water emulsions is recommended, according to the bulletin. The Finishing Lime Association of Ohio.

***Hot Process Softeners*** **295**

How they work, advantages, and applications for hot process water softeners are presented in 32-page bulletin 2341. In addition to diagrams to show piping arrangements for various systems, cutaways and photos are also used to illustrate the units. Special applications, description of parts, control valves, electrochemical solution feeders, supplementary treatments, test equipment and instrumentation are also dealt with. The Permutit Co.

***Water Conditioning*** **296**

Various methods of conditioning water and the purposes served by each are covered in illustrated 20-page bulletin 611. How to make any water softener deliver from three to ten times more soft water is described. Water softener of improved design and a deionizer of single-tank design are featured. Chemical feed, zeolite post treatment and alkalinity neutralization, and split-stream dealkalization systems for boiler, process and general water conditioning purposes are covered. Sections of the bulletin are devoted to latest type filters, purifiers, degasitors, zeolites, ion exchange resins, and water treatments for all purposes. Elgin Softener Corp.

### MISCELLANEOUS

***Sound Control*** **297**

Series of 1-page data sheets depict various phases of sound control. Included are portable sound barriers, machinery enclosures, sound traps, soundproof rooms and transformer enclosures. Each is briefly described and illustrated with photos. Recommended applications are also given. Industrial Sound Control, Inc.

***Spray Nozzles*** **298**

Non-clogging spray nozzles for spraying, washing and cleaning all kinds of materials and equipment are illustrated and described in 4-page folder 2386. Photos of typical installations suggest a few of the applications. Tables list dimensions of nozzles for 1 to 3 in. pipe, and capacities through orifices from 5/32 to ½ in. dia at 20 to 100 psi. Link-Belt Co.

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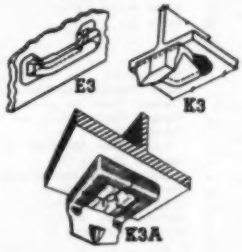


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"Cooling System Layouts for Best Diesel Performance", September, 1951

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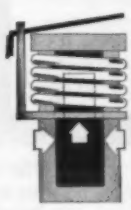

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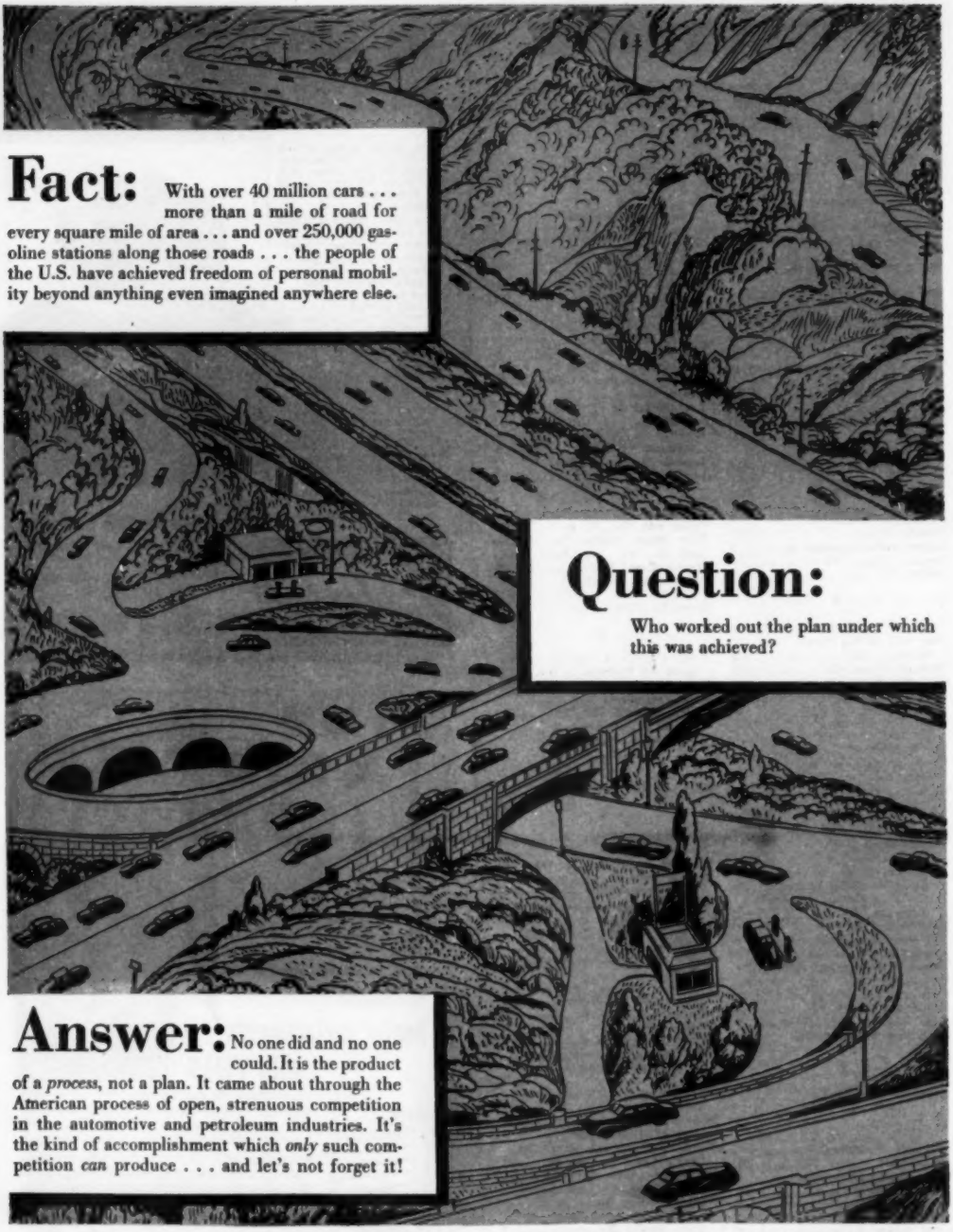

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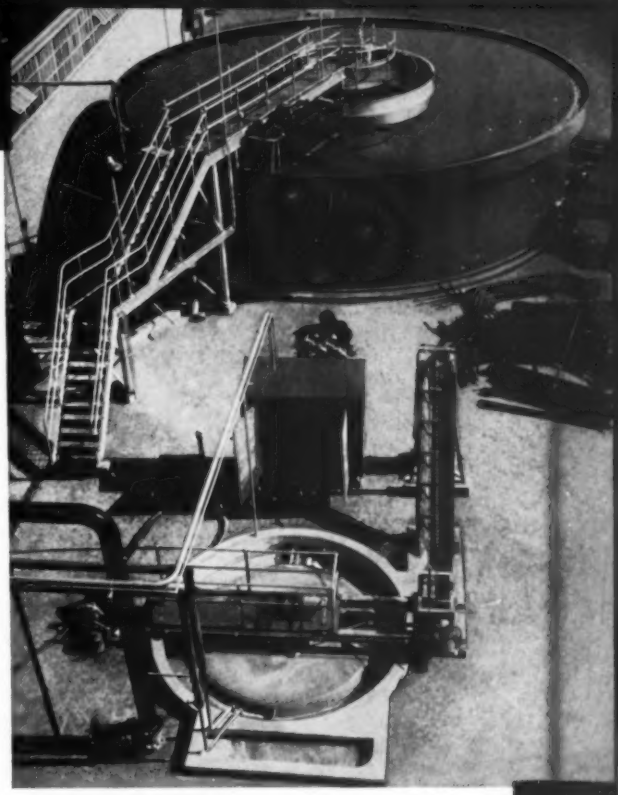

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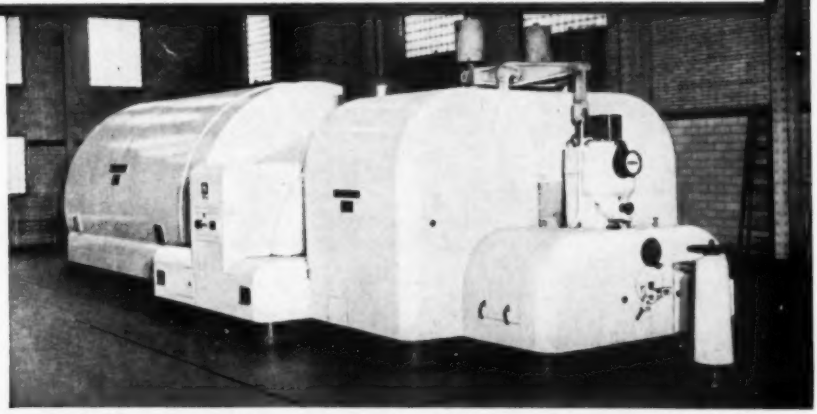

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